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JAPANESE [JP,09-252480,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] In case the wireless terminal in the wireless zone which two or more base transceiver stations connected to the communication network form, and the partner terminal held in said network communicate mutually In the network control unit which performs network control between said base transceiver station accompanying migration between the wireless zones of said wireless terminal, and said partner terminal A setting means to set up the convention field on the basis of the wireless zone where said wireless terminal belongs, A means to transmit the transmission information from a partner terminal is provided to two or more base transceiver stations which form the wireless zone belonging to the convention field set up with this setting means. Said setting means It is the network control unit characterized by setting up a convention field by making the wireless zone of the migration place of said wireless terminal into new criteria when said wireless terminal moves.
[Claim 2] In case the wireless terminal in the wireless zone which two or more base transceiver stations connected to the communication network form, and the partner terminal held in said network communicate mutually In the network control unit which performs network control between said base transceiver station accompanying migration between the wireless zones of said wireless terminal, and said partner terminal A setting means to set up the convention field on the basis of the wireless zone where said wireless terminal belongs, As opposed to two or more base transceiver stations which form the wireless zone belonging to the convention field set up with this setting means The 1st transmitting means which transmits the transmission information from a partner terminal, and the 2nd transmitting means which transmits the transmission information from a partner terminal to the base transceiver station which forms the wireless zone where said wireless terminal belongs, According to the demand quality of the communication link between said wireless terminals and partner terminals, a selection means to choose either is provided among said 1st transmitting means and said 2nd transmitting means. Said setting means It is the network control unit characterized by setting up a convention field by making the wireless zone of the migration place of said wireless terminal into new criteria when said wireless terminal moves.
[Claim 3] Said setting means is a network control unit according to claim 1 or 2 characterized by changing the range of the convention field on the basis of the wireless zone where said wireless terminal belongs according to the demand quality of the communication link between said wireless terminals and partner terminals.
[Claim 4] A storage means to memorize the transition hysteresis between the wireless zones accompanying migration of said wireless terminal is provided further. Said setting means The network control unit according to claim 1 or 2 characterized by setting up the convention field on the basis of the wireless zone where the movable direction of said wireless terminal is searched for based on the transition hysteresis between the wireless zones memorized with said storage means, and said wireless terminal belongs in this movable direction.
[Claim 5] A storage means to memorize the transition hysteresis between the wireless zones accompanying migration of said wireless terminal is provided further. Said setting means The network control unit according to claim 1 or 2 characterized by setting up the convention field

on the basis of the wireless zone where the migration direction of said wireless terminal is predicted based on the transition hysteresis between the wireless zones memorized with said storage means, and said wireless terminal belongs in this predicted migration direction.
[Claim 6] A storage means to memorize the transition hysteresis of the wireless zone accompanying migration of said wireless terminal is provided further. Said setting means Based on the transition hysteresis of the wireless zone memorized with said storage means, the movable direction of said wireless terminal is searched for. Furthermore, the network control unit according to claim 1 or 2 characterized by setting up the convention field on the basis of the wireless zone where the migration direction of said wireless terminal is predicted along that movable direction, and said wireless terminal belongs in this predicted migration direction.
[Claim 7] It is the network control unit according to claim 1 or 2 which possesses further a storage means memorize the transition hysteresis of the wireless zone accompanying migration of said wireless terminal, and is characterized by for said setting means to change the range of the convention field on the basis of the wireless zone where it asks for the passing speed of said wireless terminal based on the transition hysteresis of the wireless zone memorized with said storage means, and said wireless terminal belongs according to the passing speed.
[Claim 8] Said setting means is a network control unit according to claim 1 or 2 characterized by setting up more widely than the range of the convention field of the wireless terminal beforehand notified when it was not used having moved in the range of the convention field of the wireless terminal beforehand notified when it was used having moved.
[Claim 9] Said setting means is a network control unit according to claim 1 or 2 characterized by setting up more widely than the range of the convention field of the wireless terminal notified beforehand if it is not used moving in the range of the convention field of the wireless terminal beforehand notified when it was used having moved, and setting up widely the range of the convention field of said wireless terminal, so that the passing speed notified further beforehand is large.
[Claim 10] The usable band on said communication network assigned to a wireless terminal with the small passing speed notified beforehand is a network control unit according to claim 1 or 2 characterized by controlling to become larger than the usable band assigned to a wireless terminal with the large passing speed notified beforehand.
[Claim 11] The communication link quality of said communication network to a wireless terminal with the small passing speed notified beforehand is a network control unit according to claim 1 or 2 by which it is controlling—to become higher than communication link quality over wireless terminal with large passing speed notified beforehand characterized.
[Claim 12] A storage means to memorize the transition hysteresis between the wireless zones accompanying migration of said wireless terminal is provided further. From at least the migration direction of said wireless terminal predicted based on the transition hysteresis between the wireless zones memorized with this storage means, and one side of passing speed It is the network control unit according to claim 1 or 2 characterized by securing the band of the exchange of the migration place when the exchange which connects said base transceiver station and performs the data exchange on said communication network is judged to differ with migration of said wireless terminal.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] A base transceiver station is mutually connected with a communication network, and it is related with the network control unit in the communication system which holds a wireless terminal.
[0002]
[Description of the Prior Art] Recently, the expectation for service by the wireless which harnessed the convenience is growing by the appearance of a small cellular phone and a small portable information device. On the other hand, with the ATM network of a cable system, the communication link of a high-speed broadband is attained and the multimedia environment by this is being built. A base transceiver station is connected with an ATM network, and if it becomes possible to offer the multimedia environment in the high-speed broadband in a cable system by the wireless system, it will become possible to build the multimedia environment which harnessed the convenience of wireless.
[0003] Conventionally, many cellular system is adopted as an approach of connecting a wireless system with a cable system. This is a method which assigns a frequency which divides a wireless service area into two or more zones (a wireless zone is called henceforth) 1a-7a, and is different in each as shown in drawing 14 . Unless the wireless zone which uses the same frequency touches, the frequency which other wireless zones are using is reusable. Thereby, the frequency in a radio-transmission way can be used effectively. Base transceiver stations 101-107 form each wireless zones 1a-7a, respectively. These base transceiver stations are connected to the exchanges 110 and 111 connected to the cable network, and the wireless terminal 113 can communicate with the terminal 112 connected to other wireless terminals or cable networks.
[0004] Drawing 14 shows signs that information is transmitted to the wireless terminal 113 from the terminal 112. The wireless terminal 113 detects first to which wireless zone it is moving, when it is managed serially to which wireless zone it belongs and the wireless terminal 113 moves. It is judged by the receive state of the signal transmitted from a base transceiver station, for example, the reinforcement of received power, by this detection. This receive state is notified to the radio control station 114, and the radio control station 114 changes a connection to the base transceiver station which takes charge of the wireless zone of a migration place. This transmits the transmit information from a transmit terminal. Henceforth, the boundary of this change in a wireless zone will be changed here, and will be called a field.
[0005] As another means of a change, in order to stop hits, the following means are taken. After detecting to which wireless zone it is moving, in the border area of the wireless zone of a moved material, and the wireless zone of a migration place, the connection to the base transceiver station which takes charge of the wireless zone of a migration place where the connection to the base transceiver station which takes charge of the wireless zone of a moved material is held is set up, and the transmit information from a transmit terminal is transmitted to both the wireless zone of a moved material, and the wireless zone of a migration place through both this connection. Then, if it goes into the wireless zone of a migration place completely across the above-mentioned change border area, the connection to the base transceiver station which

takes charge of the wireless zone of a moved material will be canceled, and it transmits only to the wireless zone of ******.

[0006]

[Problem(s) to be Solved by the Invention] In order for a wireless system to also realize quality service in a cable network, it is necessary to enable the communication link of a high-speed broadband also on a radio-transmission way. In order for the conventional cellular system to realize this, if it is necessary to accelerate the transmission speed in each wireless zone, for this reason a millimeter wave etc. is used, that special feature to a wireless zone will become narrow. By becoming narrow, the handover at the time of migration of a wireless terminal comes to arise frequently.

[0007] At the time of a handover, in order to change the wireless zone where a wireless terminal belongs, it is necessary to change the connection of a cable system who is transmitting information to the base station which takes charge of the wireless zone. In order for this change to take time amount, communicative hits arise. It not only reduces communication link quality, but these hits reduce the transmission efficiency in a cable network by a lot of resending, when a lot of information is being transmitted to the high speed. A handover arises from the above-mentioned reason frequently, so that a wireless zone becomes narrow, and hits occur frequently.

[0008] By the approach of setting up the connection to a base transceiver station who takes charge of the wireless zone of a migration place from a transmit terminal after detecting the wireless zone of a migration place like before, in order to make it a wireless zone not produce hits under a narrow situation, it is necessary to perform a connection setup at a high speed very much. This originates in the time amount belonging to one wireless zone becoming short, if the wireless terminal is moving in the inside of a narrow wireless zone. However, since it becomes the situation that there are no allowances in a band when the base transceiver station is held in the network which has also served the communication link of cable terminals, the time amount which a connection setup takes in addition to the latency time until a band is vacant is needed, and a situation with it very difficult [to perform a connection setup at a high speed] may arise. Before the above-mentioned connection is set up, when a wireless terminal moves to another wireless zone, as for the wireless terminal under migration, the period of hits may become the situation of a communication interruption over long duration continuously as a result.

[0009] Moreover, even when a wireless zone is large, a phenomenon which goes back and forth between the wireless zones on the boundary produces the wireless terminal which the change boundary between wireless zones may be carrying out the complicated configuration, and moves on the boundary, and a situation which repeats a handover between short time as a result may happen. Also in such a case, the communication interruption of long duration may be caused for the same reason as the above.

[0010] Then, this invention is made in view of the above-mentioned trouble, presses down very low the possibility of the hits at the time of the handover accompanying migration of a wireless terminal, and aims at offering the network control unit which can moreover aim at the band of a cable network, and improvement in the use effectiveness of a radio channel.

[0011] That is, the probability which the above-mentioned transmit information can receive succeedingly not only in the wireless zone where the wireless terminal belongs but in the previous wireless zone where the wireless terminal moved since a connection was beforehand secured to the base transceiver station which takes charge of two or more wireless zones which exist in the movable direction from this wireless zone and the transmit information from a transmit terminal was multicasted becomes high, and it becomes possible to make very low possibility of the hits at the time of a handover. Moreover, since the number of the wireless zones which should be carried out a multicast by using the possibility of the migration direction of the communication link quality demanded and a wireless terminal, prediction of the migration direction, and passing speed can be stopped as much as possible, the use effectiveness of the band of a cable network or a radio channel can be raised, reducing the probability of hits.

[0012]

[Means for Solving the Problem] In case the wireless terminal in the wireless zone which two or

more base transceiver stations connected to the communication network form, and the partner terminal held in said network communicate mutually, the network control unit of this invention In the network control unit which performs network control between said base transceiver station accompanying migration between the wireless zones of said wireless terminal, and said partner terminal A setting means to set up the convention field on the basis of the wireless zone where said wireless terminal belongs, A means to transmit the transmission information from a partner terminal is provided to two or more base transceiver stations which form the wireless zone belonging to the convention field set up with this setting means. Said setting means When said wireless terminal moves, by setting up a convention field by making the wireless zone of the migration place of said wireless terminal into new criteria, the possibility of the hits at the time of the handover accompanying migration of a wireless terminal is pressed down very low, and, moreover, the band of a cable network and improvement in the use effectiveness of a radio channel can be aimed at.

[0013] Moreover, in case the wireless terminal in the wireless zone which two or more base transceiver stations connected to the communication network form, and the partner terminal held in said network communicate mutually, the network control unit of this invention In the network control unit which performs network control between said base transceiver station accompanying migration between the wireless zones of said wireless terminal, and said partner terminal A setting means to set up the convention field on the basis of the wireless zone where said wireless terminal belongs, As opposed to two or more base transceiver stations which form the wireless zone belonging to the convention field set up with this setting means The 1st transmitting means which transmits the transmission information from a partner terminal, and the 2nd transmitting means which transmits the transmission information from a partner terminal to the base transceiver station which forms the wireless zone where said wireless terminal belongs, According to the demand quality of the communication link between said wireless terminals and partner terminals, a selection means to choose either is provided among said 1st transmitting means and said 2nd transmitting means. Said setting means When said wireless terminal moves, by setting up a convention field by making the wireless zone of the migration place of said wireless terminal into new criteria, the possibility of the hits at the time of the handover accompanying migration of a wireless terminal is pressed down very low, and, moreover, the band of a cable network and improvement in the use effectiveness of a radio channel can be aimed at.

[0014] Moreover, the use effectiveness of the band of a cable network or a radio channel can be raised by controlling the range which the above multicasts according to the demand quality of the communication link between a partner terminal and a wireless terminal. That is, when demand quality cannot be satisfied by hits, it is made large, and the range which the above multicasts is narrowed when that is not right.

[0015] Moreover, though natural, it depends for the method of transition between the wireless zones accompanying migration of a wireless terminal on the layout of rooms, such as office. That is, the possibility of the migration direction is decided in a private network depending on an office layout. Office in recent years is in the environment of the layout free-lancer by organization amendment who can change a layout freely. Especially the location of a partition or a desk specifies the path where people move. The movable direction of a wireless terminal can be found out by observing the migration pattern between wireless zones for a movable direction, and saving hysteresis from this, even if it changes an office layout. Therefore, it becomes possible to use the band and radio channel of a cable network effectively by stretching the connection of a cable network only to the base transceiver station which takes charge of the wireless zone of a movable direction on the basis of the wireless zone where a wireless terminal belongs at present, and multicasting the transmit information from a transmit terminal.

[0016] Moreover, it becomes possible to reduce the probability of hits and to use the band and radio channel of a cable network effectively by observing the migration pattern of a wireless terminal, predicting the migration direction, stretching the connection of a cable network to the base transceiver station which takes charge of the wireless zone which exists in the migration direction, and multicasting the transmit information from a transmit terminal. It is possible by

using the information on the possibility of the above-mentioned migration direction for this means to raise the precision of this prediction further.
[0017] Moreover, the probability of the hits at the time of a handover can be reduced by multicasting the transmit information from a transmit terminal to the wireless zone where a larger convention field is prepared to a wireless terminal with large passing speed on the basis of the wireless zone where this wireless terminal belongs, and that convention field belongs. It functions effectively that this multicasts the transmit information from a transmit terminal as many wireless zones which exist in the migration direction of a wireless terminal since the opportunity of the handover per unit time amount increases as a wireless terminal with large passing speed.
[0018] Moreover, the band and radio channel of a cable network can be effectively used for the terminal which transmits the transmit information from a transmit terminal only to the base transceiver station which takes charge of the wireless zone where the wireless terminal belongs, and moves to the wireless terminal which does not move by notifying migratory [of a wireless terminal] beforehand before communicating by preparing an above more large convention field. It is possible to fall the possibility of hits further by making passing speed notify to the wireless terminal which moves further, and deciding the range of a convention field to be such a large field that this notified passing speed be large.
[0019] The probability of hits can be sharply reduced by the multicast with the means using the possibility of the above migration direction, prediction of the migration direction, and passing speed. Although the wireless terminal which moves will use many network resources with this means By narrowing an usable band to a wireless terminal with large passing speed, and making an usable band large to a wireless terminal with conversely small passing speed It becomes possible to maintain the fairness of network resource use among the users who stop with the user who uses a wireless terminal and use a wireless terminal, moving. Moreover, it is making communication link quality low to a wireless terminal with large passing speed as another means, and making communication link quality high to a wireless terminal with conversely small passing speed. While aiming at a deployment of the band of a cable network, it becomes possible to hold the fairness of network resource use between the user who uses a wireless terminal, a low speed, or the user who stops and uses a wireless terminal, moving to a high speed.
[0020] Furthermore, it originates in the change boundary between wireless zones carrying out the complicated configuration, and the following effectiveness is acquired by the means of this invention also to the situation that the wireless terminal which moves on the boundary repeats a handover between short time. That is, it becomes possible by multicasting the information from a transmit terminal to prevent the hits by this handover repeated to the wireless zone which forms this boundary at least.
[0021]
[Embodiment of the Invention] The operation gestalt of this invention is explained with reference to a drawing.
(1st operation gestalt) Drawing 1 shows roughly the configuration of the whole communication network concerning the 1st operation gestalt.
[0022] In drawing 1 , it connects so that it can communicate mutually through the exchange 230, and two or more base transceiver stations 201-227 (drawing 1 shows some base transceiver stations of them) and radio control offices 233 constitute the network. Here, the exchange 230 is the ATM (Asynchronous Transfer Mode) exchange and uses as an ATM network the network which connects a base transceiver station.
[0023] Each base transceiver stations 201-227 form the wireless zones 1-27, respectively. Now, the situation of receiving the transmit information from the terminal 231 by which the wireless terminal 232 was connected to the exchange 230 is considered.
[0024] The radio control station 233 has memorized the information that the wireless terminal 232 exists in the wireless zone 14. Furthermore, the radio control office 233 is memorized as a table showing the physical relationship of all wireless zones in below-mentioned drawing 5 , and controls the exchange 230 to stretch a connection so that the transmit information from a transmit terminal 131 can be multicasted from a cable network to the wireless zone 14 and the

wireless zones 8, 9, 15, 20, 19, and 13 around it. That is, as shown in drawing 1 , the transmit information from a transmit terminal 231 is multicasted to base transceiver stations 214, 208, 209, 215, 220, 219, and 213 by the exchange 230, and these base transceiver stations carry out the radio transmission of the transmit information to the wireless zones 14, 8, 9, 15, 20, 19, and 13 which each takes charge of.

[0025] Two or more wireless zones which multicast the transmit information from a terminal 231 through a base transceiver station are made to call it a convention field here. With reference to drawing 2 , it explains to a detail further.

[0026] Drawing 2 shows signs that the whole region of the square room surrounded by the wall 300 is covered with the wireless zones 1-27 where 27 base transceiver stations 201-227 of drawing 1 correspond. Moreover, the wireless zone by which a multicast is carried out in case the wireless terminal 232 exists in the wireless zone 14 is expressed with the circle of a thick wire. That is, the field expressed with the circle of a thick wire is a convention field.

[0027] This multicast becomes possible by giving a copy function to the exchange 230. Since the multicast of the same information as the wireless zone 14 before migration is carried out by this even if the wireless terminal 232 moves to which surrounding wireless zone of the wireless zone 14, the hits by the handover are not produced.

[0028] now, as shown in drawing 3 , when 232 moves to the wireless zone 15 from the wireless zone 14 in the end of a non-tip The base transceiver station is supervising the receive state of the electric wave sent out from the wireless terminal 232, notify it to the radio control station 233, and it detects that the wireless terminal moved the radio control station 233 to the wireless zone 15. The exchange 230 is controlled to stretch a connection so that the transmit information from a terminal 231 can be multicasted as the surrounding wireless zones 9, 10, 16, 21, 20, and 14 of the wireless zone 15 from a cable network. This prepares for migration of the next time of the wireless terminal 232. In addition, in drawing 3 , the same sign is given to the same part as drawing 1 , and explanation is omitted.

[0029] A convention field when the wireless terminal 232 moves to the wireless zone 15 at drawing 4 is shown. In addition, in drawing 4 , the same sign is given to the same part as drawing 2 , and explanation is omitted. At drawing 4 , the wireless zone by which a multicast is carried out when the wireless terminal 232 moves to the wireless zone 15 is expressed with the circle of a thick wire.

[0030] The radio control station 233 is controlling by repeating such a procedure with migration of a wireless terminal to multicast the transmit information from the partner terminal 231 to the wireless zone where a wireless terminal always belongs and the surrounding wireless zone of the wireless zone, i.e., a convention field.

[0031] In the case of the above-mentioned multicast connection control, it carries out with reference to a table as shown in drawing 5 managed in the radio control office 233. In addition, in drawing 5 , ID of the base transceiver station which forms drawing 2 and each wireless zones 1-27 of drawing 4 is set to 1-27, respectively, and ID of the base transceiver station of the near is memorized corresponding to each of a base transceiver station ID.

[0032] The radio control station 233 can pinpoint the base transceiver station which should carry out the multicast of to which wireless zone a wireless terminal belongs from this table if it pursues and ID of that wireless zone becomes clear.

[0033] For example, the base transceiver station near the base transceiver station 314 of ID14 is a base transceiver station of ID 8, 9, 15, 20, 19, and 13, and if this table is referred to, a convention field in case the wireless terminal 232 exists in the wireless zone 14 will serve as the wireless zones 8, 9, 15, 20, 19, and 13 which base transceiver stations 208, 209, 215, 220, 219, and 213 form.

[0034] This invention functions effectively, also when the base transceiver station change boundary between wireless zones is complicated, as shown in drawing 6 . This change boundary is judged as mentioned above, for example with the reinforcement of the signal power which a wireless terminal receives from a base transceiver station. With the directivity of a surrounding body or the antenna of a base transceiver station etc., this change boundary may become complicated, as shown in drawing 6 . For example, when it follows and a wireless terminal moves

the path of the arrow head shown in drawing 6 , the probability to wander from place to place with the wireless zones 36, 30, 36, and 30, for 4 times of handovers to be performed sequentially from the wireless zone 30, and for hits to happen becomes high. If it may go in this path, between short time, further many handovers will be performed and the probability of hits will become higher.

[0035] According to this operation gestalt, also in such a situation, it is solved easily. That is, like the above-mentioned, when a wireless terminal is in the wireless zone 30, with reference to the table shown in drawing 5 , the radio control office 233 sets up the convention field which consists of a wireless zone 30 used as criteria, and wireless zones 31, 32, 33, 34, 35, and 36 of that near, and multicasts the transmit information from a transmit terminal to the base transceiver station of this convention field. Similarly, when a wireless terminal is in the wireless zone 36, the convention field which consists of a wireless zone 36 used as criteria and wireless zones 38, 31, 30, 35, 36, and 37 of that near is set up, and the transmit information from a transmit terminal is multicasted to the base transceiver station of this convention field.

[0036] Thus, as mentioned above, even if it is in the situation which carries out the handover of the wireless zones 30 and 36, since the multicast of the transmit information from a transmit terminal is carried out to these wireless zones 30 and 36, hits will be produced.

[0037] The ATM network which connects between the base transceiver stations used with this operation gestalt can offer service of various transmission speed and communication link quality. With an ATM network, it transmits as a packet which added 5 bytes of header which divided transmit information per 48 bytes and wrote in the transmitting destination etc. This packet is called a cel. Communication link quality is expressed by the waste ratio of arrival delay of this cel, or a cel.

[0038] With an ATM network, the class classified according to the transmission speed of a cel and communication link quality is prepared, and a user communicates by choosing a desired communication link class. For example, if it is extent which can recognize as voice in the case of voice communication, and can understand the contents to it, since a cel may be discarded somewhat, the desired value to a cel waste ratio is low. However, since real time nature is required in order to talk with voice, the demand about delay becomes severe. That is, in the case of voice communication, the allowed value of a waste ratio will be large and will choose the small communication link class of the allowed value of delay. Although the desired value to a cel waste ratio is severe on the other hand in order to avoid a lot of resending by data communication especially in the case of high-speed transmission, the demand about delay is loose. Therefore, in this case, the allowed value of a waste ratio will be small and will choose the large communication link class of the allowed value of delay. Thus, it is one description of an ATM network that communication link quality can be chosen according to the communicative contents.

[0039] furthermore -- an ATM network -- voice -- like -- a cel waste ratio -- receiving -- tolerance -- being also large -- it is alike, and it receives and tolerance is usually large also to hits. In such a case, it does not multicast to two or more above wireless zones, but the information from a transmit terminal is transmitted only to the wireless zone where a wireless terminal belongs. On the contrary, when the tolerance to hits is a severe communication link, the multicast to two or more wireless zones is performed as mentioned above, and the probability for hits to arise is reduced.

[0040] In case the radio control station 233 sets up a connection between a partner terminal and a wireless terminal, specifically the demand parameter (for example, a permission cel loss ratio --) of the communication link quality beforehand notified by the user Based on permission cel transfer delay time amount etc., either of the transmission only to the multicast to the convention field which consists of a wireless zone where a wireless terminal belongs, and a wireless zone of the near, and the wireless zone where a wireless terminal belongs is chosen.

[0041] By performing such a selection control, it becomes possible to use the band and radio channel of an ATM network effectively. As explained, according to the operation gestalt of the above 1st, as mentioned above, the radio control station 233 As opposed to two or more base transceiver stations which take charge of the wireless zone which prepares the convention field

on the basis of the location of the wireless zone where the wireless terminal 232 belongs, and belongs to this convention field As opposed to two or more base transceiver stations which take charge of the wireless zone which multicasts, establishes the convention which made the wireless zone of a migration place new criteria when [which transmits the transmission information from a transmit terminal 231] the wireless terminal 232 moves, and belongs to this convention field By transmitting the transmission information from a transmit terminal 231 by the multicast Since a connection is beforehand secured to the base transceiver station which takes charge not only of the wireless zone where the wireless terminal belongs but of two or more wireless zones which exist in the movable direction from this wireless zone and the transmit information from a transmit terminal is multicasted, The probability which the above-mentioned transmit information can receive succeedingly also in the previous wireless zone where the wireless terminal moved becomes high, and it becomes possible to make very low possibility of the hits at the time of a handover.

[0042] Moreover, the radio control station 233 receives two or more base transceiver stations which take charge of the wireless zone which prepares the above-mentioned convention field on the basis of the location of the wireless zone where the wireless terminal 232 belongs, and belongs to this convention field. Either of whether the transmission information from a transmit terminal 231 is transmitted to the base transceiver station which takes charge of the wireless zone where whether the transmission information from a transmit terminal 231 being transmitted and the wireless terminal 232 belong Since the number of the wireless zones which should be carried out a multicast by choosing according to the demand quality of the communication link beforehand notified between the transmit terminal 231 and the wireless terminal 232 can be stopped as much as possible, The use effectiveness of the band of a cable network or a radio channel can be raised reducing the probability of hits.

[0043] Furthermore, it becomes possible to prevent the hits by this handover repeated by originating in the change boundary between wireless zones carrying out the complicated configuration, and multicasting the information from a transmit terminal to the wireless zone which forms this boundary at least also to the situation that the wireless terminal which moves on that boundary repeats a handover between short time.

[0044] (2nd operation gestalt) With reference to drawing 7 , the principle of the 2nd operation gestalt of this invention is explained first. Drawing 7 shows signs that radio-transmission service is performed in the wireless zones 1-27 to the room where the path 301 was set as the room surrounded by the wall 300 by layout modification like drawing 2 . Places other than path 301 presuppose that the desk is set up. In this case, what it may move frequently at is a path 301, and the circumference of a desk has large possibility of stopping and using it. The wireless zone where a wireless terminal belongs changes with migration of a wireless terminal, and this is dependent on the layout of such a room, though natural.

[0045] Office in recent years can make now a layout change by organization amendment etc. freely by the appearance of a dismountable partition etc. If a wireless zone covers the whole room as shown in drawing 7 , it will become as [be / radio-transmission service / in the whole region / possible], and it can respond to various layouts in such office changed occasionally.

[0046] In order to prevent the hits by the handover as much as possible by such office environment, using the band and radio channel of the cable section effectively, the technique of the 2nd operation gestalt of searching for the possibility of transition between the wireless zones of a wireless terminal by observation is very effective.

[0047] Although the convention field was prepared with the 1st above-mentioned operation gestalt so that hits might not arise even if the wireless terminal 232 moved in which direction in the future On the other hand, it observes and asks for transition between the wireless zones according the movable direction of the wireless terminal 232 to the past handover with the 2nd operation gestalt. The wireless zone with the wireless zone where a wireless terminal belongs multicasts the transmit information from a transmit terminal to the wireless zone which exists in the movable direction. Since the number of the wireless zones multicasted by this, preventing hits can be reduced, a band can be used effectively also not only on a cable part but on a radio-transmission way.

[0048] Next, a means to search for the movable direction of the wireless terminal 232 is explained concretely. Here, the ID number for distinguishing 27 wireless zones presupposes that it is the same as that of the sign given to the wireless zone shown in drawing 7 . Moreover, if it shall have memorized as a table showing the physical relationship of all wireless zones in drawing 5 , since the radio control office 233 is the maximum 6 of the number of each wireless zone to movable adjoining wireless zones, it can express the transition between wireless zones with the matrix Gposs of 27x6 of a degree type (1).

[0049]

[Equation 1]

$$G_{poss}=\begin{bmatrix} g_{1,1} & g_{1,2} & g_{1,3} & \cdots & g_{1,6} \\ g_{2,1} & g_{2,2} & g_{2,3} & \cdots & g_{2,6} \\ g_{3,1} & g_{3,2} & \ddots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \ddots & g_{26,6} \\ g_{27,1} & g_{27,2} & \cdots & g_{27,5} & g_{27,6} \end{bmatrix} \quad \cdots (1)$$

[0050] Here, initial value of each element gij of Matrix Gposs is set to "0." Although the number i of each line expresses the ID number of a wireless zone, the element of each line is equivalent to the element of the wireless zone ID which each line of the table shown in drawing 5 shows. for example, the wireless zone where the party eye of Gposs can change from the wireless zone of ID number 1 -- being shown -- **** -- the table of drawing 5 -- following -- g -- 1 and 1 the transition to the wireless zone 2 from the wireless zone 1, and g -- 1 and 2 the transition to the wireless zone 7 from the wireless zone 1, and g -- 1 and 3 The transition to the wireless zone 6 from the wireless zone 1 is expressed. since the adjoining wireless zone which can change from the wireless zone 1 is only three [more than] -- g -- 1 and 4g -- 1 and 5g -- 1 and 6 Initial value is maintained in this case and it is set to "0" so that it may not have semantics but the following explanation may show.

[0051] Matrix Gposs sets the element gij showing transition between wireless zones as "1", when transition arises between wireless zones. For example, if drawing 7 is considered for an example, a path 301 is located in the room of this drawing, and since a wireless terminal is movable only at this path, Matrix Gposs will become like a degree type (2).

[0052]

[Equation 2]

$$G_{poss}=\begin{bmatrix}
0&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&1&0&1&0\\
0&0&1&0&0&1\\
0&0&1&0&0&1\\
0&0&1&0&0&1\\
0&0&0&0&0&1\\
0&1&0&1&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0
\end{bmatrix} \quad \cdots (2)$$

[0053] While a wireless terminal actually moves, whenever it communicates by such processing, it gains as possible transition between wireless zones. This becomes a pattern reflecting the layout of the room in order to give movable transition of a wireless terminal. It becomes possible to use the band and radio channel of a cable network effectively by multicasting the information from a transmit terminal only to the possible wireless zone of transition based on the transition information between wireless zones as shown in this gained formula (2).

[0054] Although the convention field which is specifically set up to the wireless terminal 232 which exists in the wireless zone 14 in the case of the 1st above-mentioned operation gestalt serves as the wireless zone 14 and the wireless zones 8, 9, 15, 20, 19, and 13 around it Since existence of a path 301 can be grasped using transition information like a formula (2) in the case of the 2nd operation gestalt, a convention field serves as the wireless zones 14, 13, and 15. Therefore, when these are compared, it turns out easily that the number of the wireless zones which multicast the transmit information from the partner terminal 231 can be limited more.

[0055] As mentioned above, as explained, according to the operation gestalt of the above 2nd, the transition hysteresis between the wireless zones in migration of the wireless terminal 232 is memorized. It becomes possible to use the band and radio channel of a cable network effectively by searching for the movable direction of a migration terminal from this memorized transition hysteresis information, and preparing the convention field on the basis of the location of the wireless zone where the wireless terminal 232 belongs in this movable direction.

[0056] (3rd operation gestalt) With the 3rd operation gestalt, it is characterized by observing the frequency of transition between the wireless zones where a wireless terminal belongs, and securing and multicasting a band preferentially to a wireless zone with much this frequency that changes. Thereby, it aims at lowering the probability of hits, making effectively the most of the band and radio channel of a cable network.

[0057] Next, a means to observe the frequency of transition of a wireless zone where the wireless terminal 232 belongs, and to predict the migration direction is concretely explained with reference to drawing 7 . Here, the ID number for distinguishing 27 wireless zones presupposes that it is the same as that of the number of the wireless zone shown in drawing 7 like the 2nd example. Moreover, if it shall have memorized as a table showing the physical relationship of all wireless zones in drawing 5, since the radio control office 233 is the maximum 6 of the number of each wireless zone to movable adjoining wireless zones, it can express the frequency of transition between wireless zones with the matrix S of 27x6 of a degree type (3).

[0058]

[Equation 3]

$$S=\begin{bmatrix} s_{1.1} & s_{1.2} & s_{1.3} & \cdots & s_{1.6} \\ s_{2.1} & s_{2.2} & s_{2.3} & \cdots & s_{2.6} \\ s_{3.1} & s_{3.2} & \ddots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \ddots & s_{26.6} \\ s_{27.1} & s_{27.2} & \cdots & s_{27.5} & s_{27.6} \end{bmatrix} \quad \cdots (3)$$

[0059] Here, initial value of each element Sij of Matrix S is set to "0." Although the number i of each line expresses the ID number of a wireless zone, the element of each line is equivalent to the element of the wireless zone ID which each line of the table shown in drawing 5 shows. for example, the wireless zone where the party eye of Matrix S can change from the wireless zone of an ID number "1" — being shown — **** — the table of drawing 5 — following — S — 1 and 1 the transition to the wireless zone 2 from the wireless zone 1, and S — 1 and 2 the transition to the wireless zone 7 from the wireless zone 1, and S — 1 and 3 The transition to the wireless zone 6 from the wireless zone 1 is expressed. since the adjoining wireless zone which can change from the wireless zone 1 is only three [more than] — S — 1 and 4S — 1 and 5S — — 1 and 6 Initial value is maintained in this case and it is set to "0" so that it may not have semantics but the following explanation may show.

[0060] Matrix S adds "1" to the element Sij showing transition between wireless zones, when transition arises between wireless zones. By repeating this processing, a place with much transition serves as a big value. For example, if drawing 7 is considered for an example, since a path 301 is located in the room of this drawing and a wireless terminal is movable only at this path, Matrix S becomes like for example, a degree type (4).

[0061]

[Equation 4]

$$S=\begin{bmatrix}
0&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
9&0&9&0&1&0\\
0&0&9&0&0&7\\
0&0&9&0&0&5\\
0&0&2&0&0&1\\
0&0&0&0&0&1\\
0&1&0&1&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0
\end{bmatrix} \quad \cdots (4)$$

[0062] While a wireless terminal actually moves, whenever it communicates by such processing, the frequency of transition between wireless zones is gained. Using the frequency information on transition between wireless zones like this gained formula (4), the previous wireless zone where a wireless terminal moves can be predicted. That is, since it is thought that the probability for a wireless terminal to move to a wireless zone with much frequency of transition is high, it becomes possible by securing a band preferentially and multicasting the information from a transmit terminal to use effectively the band of a cable-transmission way and a radio-transmission way.

[0063] Since the convention field specifically set up to the wireless terminal 232 which exists in the wireless zone 14 can grasp existence of a path 301 using transition information like a formula (2) in the case of the 2nd operation gestalt, it serves as the wireless zones 14, 13, and 15. the case of the 3rd operation gestalt -- a basis [information / on transition like a formula (4) / frequency] -- the element s of Matrix S -- the value of 14 and 15 -- s -- decision of being larger than the value of 14 and 13, i.e., the transition frequency from the wireless zone 14 to the wireless zone 15 being higher, sets up a convention field with the wireless zones 14 and 15. In other words, although the convention field of the wireless terminal 232 which exists in the wireless zone 14 in the case of the 2nd operation gestalt may serve as a wireless zone before and behind the wireless zone 14 along a path 301, it turns out that it can limit to the wireless zone 14 and 15 where the possibility of migration transition is further more high, for example, wireless zones, according to the 3rd operation gestalt.

[0064] As explained above, according to the operation gestalt of the above 3rd, the frequency of transition between the wireless zones in migration of the wireless terminal 232 is memorized. By predicting the migration direction of a migration terminal from this memorized transition hysteresis information, and making the above-mentioned convention field on the basis of the

location of the wireless zone where the wireless terminal 232 belongs into the field which exists in that migration direction It becomes possible to reduce the probability of hits and to use the band and radio channel of a cable network effectively.

[0065] Furthermore, by using the information on the possibility of the migration direction of the 2nd operation gestalt (formula (2)), the precision of this prediction can be raised and the range of a convention field can be made small.

(4th operation gestalt) With the 4th operation gestalt of this invention, the migration direction and passing speed of a wireless terminal are measured, and the transmit information from a transmit terminal is multicasted to many wireless zones which exist in the migration direction, so that passing speed is large. Thereby, since the band of the cable section to a base transceiver station is securable early, it becomes possible to lessen the probability of hits.

[0066] What is necessary is to observe this updating timing and just to measure the transition direction and the transition rate to coincidence, although "1" is added and updated by the element corresponding to the time of transition between the wireless zones of each element of the matrix S of a formula (3) in order to realize this. The wireless zone which performs a multicast according to the magnitude of this rate is determined.

[0067] With reference to drawing 8 and drawing 9 , it explains concretely. In addition, drawing 8 and drawing 9 show signs that radio-transmission service is performed in the wireless zones 1-27 to the room where the path 301 was set as the room surrounded by the wall 300 by layout modification like drawing 7 like drawing 2 . Moreover, suppose that the movable direction of the wireless terminal explained with the 2nd operation gestalt, i.e., the direction along a path 301, is already searched for.

[0068] For example, as shown in drawing 8 , when the wireless terminal 232 is in the wireless zone 13 and it is moving in the direction of the arrow head of this drawing at a low speed, the transmit information from a transmit terminal 231 is multicasted as the wireless zones 13 and 14 (circle of the thick wire of this drawing). On the other hand, as drawing 9 shows, when the wireless terminal 232 gets down to the wireless zone 13 and it is moving in the direction of the arrow head of this drawing further at high speed, the transmit information from a transmit terminal 231 is multicasted as the wireless zones 13, 14, and 15 (circle of the thick wire of this drawing).

[0069] In order that the radio control station 233 may set up the range of a convention field according to the passing speed of a wireless terminal, the radio control station 233 specifically When having memorized as a table as shows the physical relationship of all wireless zones to drawing 5 , in case the wireless terminal 232 moves dynamically with reference to this between wireless zones, you may make it set up the range of the convention field for low speeds, and the convention field for high speeds. When the wireless terminal 232 exists in the wireless zone 13 and it is detected that the migration direction is a direction shown by the arrow head of drawing 8 , namely, the range of a convention field in case passing speed is a low speed Since it is good only in the wireless zone by the side of recently which exists in the migration direction of the wireless terminal 232 along the path 301 beforehand detected on the basis of the wireless zone 13, it can set up with the wireless zone 14 immediately from drawing 5 . Since it is necessary to ask for the range of a convention field still more broadly than the wireless zone by the side of recently [of the wireless zone used as criteria] on the other hand when passing speed is a high speed, First, the inside of the recently side base transceiver station of the table of drawing 5 to the base transceiver station ID "13", The recently side base transceiver station ID of the wireless zone which exists in the migration direction of the wireless terminal 232 along a path 301 "14" is obtained. Next, the base transceiver station ID "15" of the wireless zone which exists in the migration direction of the wireless terminal 232 which was along a path 301 among the recently side base transceiver stations of a base transceiver station ID "14" is gained from the table of drawing 5 . Thereby, a convention field when the passing speed of the wireless terminal 232 which exists in the wireless zone 13 is high-speed serves as the wireless zones 13, 14, and 15.

[0070] Moreover, you may make it provide the table showing the range of the convention field for low speeds as shown in drawing 5 , for example, and the table showing the range of the

convention field for high speeds which memorized the base transceiver station ID soon still more broadly than it, respectively.
[0071] Furthermore, when the movable direction of the wireless terminal explained with the 2nd operation gestalt, i.e., the direction along a path 301, is searched for, [for example,] The range of the convention field the object for low speeds and for high speeds is gained, and you may make it memorize the range of the passing speed's result convention-field in the case of [each] a low speed and a high speed as a table dynamically with reference to the table shown for mentioning above at drawing 5 .
[0072] Now, as shown in drawing 10 , the wireless terminal 232 is moving in the direction of an arrow head, and the situation that moving to the wireless zone 15 via the wireless zone 14 is expected is considered from the wireless zone 13 where the wireless terminal 232 belongs. While the wireless terminal 232 moves in the wireless zones 13 and 14, although the base transceiver stations 213 and 214 which take charge of these wireless zones are held in the exchange 250, the base transceiver station 215 of the wireless zone 15 which is the following migration place serves as the different exchange 251. In this case, it will be necessary to change the exchange and that change will take time amount.
[0073] Then, when the migration direction and passing speed of the wireless terminal 232 are detected by the radio control station 233 with migration of the wireless terminal 232, When the change of the exchange is expected with reference to the table which expressed further the relation of the exchange which holds a base transceiver station and it about the base transceiver station of the wireless zone which exists in the migration direction of the wireless terminal 32, as shown in drawing 10 When the wireless terminal 232 of the radio control station 233 is in the wireless zone 13, it secures the band of the cable network to the exchange which connects the base transceiver station 215 which forms the wireless zone 15 a little early. Thereby, the probability of hits can be made low.
[0074] As mentioned above, as explained, according to the operation gestalt of the above 4th, it asks for the migration direction and passing speed of a migration terminal from renewal of the transition hysteresis between the wireless zones in migration of a wireless terminal. It becomes possible to reduce the probability of hits and to use the band and radio channel of a cable network effectively by changing the convention field on the basis of the location of the wireless zone where the wireless terminal 232 belongs according to the migration direction and passing speed of this wireless terminal. ****** of a convention field can be made still smaller by using the information on the possibility of the migration direction of the 2nd operation gestalt (formula (2)) for this means.
[0075] Moreover, the probability of the hits at the time of a handover can be reduced by multicasting the transmit information from a transmit terminal to the wireless zone where a larger convention field is prepared to a wireless terminal with large passing speed on the basis of the wireless zone where this wireless terminal belongs, and that convention field belongs. It functions effectively that this multicasts the transmit information from a transmit terminal as many wireless zones which exist in the migration direction of a wireless terminal since the opportunity of the handover per unit time amount increases as a wireless terminal with large passing speed.
[0076] Furthermore, when it is predicted that the exchange to which the base transceiver station in which the wireless terminal is held at present is connected differs from the exchange to which the base transceiver station in which the wireless zone of a future migration place is held is connected, the probability of the hits at the time of a handover can be reduced by securing the band of the latter exchange so that it can transmit to the base transceiver station in which the transmit information of a transmit terminal holds the latter wireless zone.
[0077] (5th operation gestalt) With the 5th operation gestalt of this invention, it notifies whether it is used while the user who uses the wireless terminal 232 moves the wireless terminal 232 to be used from now on, or it is used to a call connection demand, stopping. When the use to suspend is notified, the transmit information from a transmit terminal is transmitted only to the wireless zone 14 (circle of the thick wire of this drawing) where the wireless terminal 232 belongs as drawing 11 shows. When use while moving is notified, as drawing 12 shows, the

transmit information from a transmit terminal is transmitted to the wireless zone 14 and (for example, the path 301 which may serve as a migration place as the 2nd operation gestalt explained was met) the wireless zones 13 and 15 (circle of the thick wire of this drawing) where a wireless terminal with translatability belongs. Moreover, when passing speed is notified when moving is notified, and quick passing speed is notified, as the 4th operation gestalt explained, the transmit information from a transmit terminal is multicasted to the wireless zone covering the large range rather than the case where low passing speed is notified. For example, supposing drawing 12 shows the case of a low speed, when quick passing speed is notified, it will perform the above-mentioned multicast to more wireless zones (circle of the thick wire of this drawing) like drawing 13 .

[0078] If the case of the arrival-of-the-mail sequence to the wireless terminal 232 is taken for an example and it explains concretely, first, the wireless terminal 232 which is performing the waiting receptacle will receive the arrival-of-the-mail message transmitted from a base transceiver station, and will detect arrival of the mail. The terminal which detected arrival of the mail establishes the link channel of wireless like the time of dispatch, next establishes a layer 2, after that, with the control signal of a layer 3, between networks, performs management of a wireless resource, migratory, the report about circuit call connection control, and a negotiation, and establishes the service channel for a communication link. The information notified here, for example, the existence of migration, passing speed, communication link demand quality, etc. are passed to the radio control station 233 through the network which connected a base transceiver station and it. In the radio control station 233, a convention field is set up with reference to the received report information and the table provided.

[0079] Usually, when using moving the wireless terminal 232 at high speed, **** and when using the wireless terminal 232, stopping or moving on the other hand at a low speed, by what requires so high communication link quality, it seems [transmitting important data in many cases and] to be a communication link called the informational exchange using voice. That is, when using a wireless terminal, moving at high speed, moving the wireless terminal 232 at a low speed, the use band on a network may be narrower than the case where it stops and uses, and there may be communication link quality low.

[0080] So, it controls by the radio control station 233 to make it larger than the usable band which assigns the usable band of the network assigned to a wireless terminal with small passing speed based on the above-mentioned report information to a wireless terminal with large passing speed. Moreover, control which makes high communication link quality over a wireless terminal with small passing speed, and makes low communication link quality over a wireless terminal with large passing speed is performed. That is, in drawing 1 , the radio control office 233 transmits the signal which included initial entries, such as a use band and demand quality, in ATM switching system 230 in an ATM cel, and performs predetermined connection reception control by ATM switching system 230.

[0081] Thereby, it becomes possible to maintain the fairness of network resource use among the users who stop with the user who uses a wireless terminal and use a wireless terminal, moving. Moreover, it is making communication link quality low to a wireless terminal with large passing speed, and making communication link quality high to a wireless terminal with conversely small passing speed, and while aiming at a deployment of the band of a cable network, it becomes possible to hold the fairness of network resource use between the user who uses a wireless terminal, a low speed, or the user who stops and uses a wireless terminal, moving to a high speed.

[0082] As explained above, according to the 5th operation gestalt, the possibility of the hits at the time of the handover accompanying migration of a wireless terminal is pressed down very low from the above 1st, and the network control unit which can moreover aim at the band of a cable network and improvement in the use effectiveness of a radio channel can be offered.

[0083] That is, if a millimeter wave etc. is used in order that the conventional cellular system may accelerate the transmission speed in each wireless zone, the special feature to a wireless zone will become narrow. When a wireless zone becomes narrow, the handover at the time of migration of a wireless terminal comes to arise frequently. At the time of a handover, in order to

change the connection of a cable system who is transmitting information to the base transceiver station and for this change to take time amount, communicative hits arise. It not only reduces communication link quality, but these hits reduce the transmission efficiency in a cable network by resending, when a lot of information is being transmitted to the high speed. It becomes possible to reduce sharply the probability for these hits to arise, by this invention. Moreover, it becomes possible to stop with the wireless terminal which moves and to perform fair allocation of the network resource to the wireless terminal to be used. Moreover, also when a wireless zone is large, this invention functions effectively. That is, although it originates in the complicated configuration in the change boundary between wireless zones and a handover is repeated between short time, it enables this to prevent hits. In addition, it cannot be overemphasized that it is also effective to use from the above 1st, combining the 5th operation gestalt suitably.

[0084]

[Effect of the Invention] As explained above, according to this invention, the possibility of the hits at the time of the handover accompanying migration of a wireless terminal is pressed down very low, and the network control unit which can moreover aim at the band of a cable network and improvement in the use effectiveness of a radio channel can be offered.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] A base transceiver station is mutually connected with a communication network, and it is related with the network control unit in the communication system which holds a wireless terminal.

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PRIOR ART

[Description of the Prior Art] Recently, the expectation for service by the wireless which harnessed the convenience is growing by the appearance of a small cellular phone and a small portable information device. On the other hand, with the ATM network of a cable system, the communication link of a high-speed broadband is attained and the multimedia environment by this is being built. A base transceiver station is connected with an ATM network, and if it becomes possible to offer the multimedia environment in the high-speed broadband in a cable system by the wireless system, it will become possible to build the multimedia environment which harnessed the convenience of wireless.
[0003] Conventionally, many cellular system is adopted as an approach of connecting a wireless system with a cable system. This is a method which assigns a frequency which divides a wireless service area into two or more zones (a wireless zone is called henceforth) 1a-7a, and is different in each as shown in drawing 14 . Unless the wireless zone which uses the same frequency touches, the frequency which other wireless zones are using is reusable. Thereby, the frequency in a radio-transmission way can be used effectively. Base transceiver stations 101-107 form each wireless zones 1a-7a, respectively. These base transceiver stations are connected to the exchanges 110 and 111 connected to the cable network, and the wireless terminal 113 can communicate with the terminal 112 connected to other wireless terminals or cable networks.
[0004] Drawing 14 shows signs that information is transmitted to the wireless terminal 113 from the terminal 112. The wireless terminal 113 detects first to which wireless zone it is moving, when it is managed serially to which wireless zone it belongs and the wireless terminal 113 moves. It is judged by the receive state of the signal transmitted from a base transceiver station, for example, the reinforcement of received power, by this detection. This receive state is notified to the radio control station 114, and the radio control station 114 changes a connection to the base transceiver station which takes charge of the wireless zone of a migration place. This transmits the transmit information from a transmit terminal. Henceforth, the boundary of this change in a wireless zone will be changed here, and will be called a field.
[0005] As another means of a change, in order to stop hits, the following means are taken. After detecting to which wireless zone it is moving, in the border area of the wireless zone of a moved material, and the wireless zone of a migration place, the connection to the base transceiver station which takes charge of the wireless zone of a migration place where the connection to the base transceiver station which takes charge of the wireless zone of a moved material is held is set up, and the transmit information from a transmit terminal is transmitted to both the wireless zone of a moved material, and the wireless zone of a migration place through both this connection. Then, if it goes into the wireless zone of a migration place completely across the above-mentioned change border area, the connection to the base transceiver station which takes charge of the wireless zone of a moved material will be canceled, and it transmits only to the wireless zone of ******.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, the possibility of the hits at the time of the handover accompanying migration of a wireless terminal is pressed down very low, and the network control unit which can moreover aim at the band of a cable network and improvement in the use effectiveness of a radio channel can be offered.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In order for a wireless system to also realize quality service in a cable network, it is necessary to enable the communication link of a high-speed broadband also on a radio-transmission way. In order for the conventional cellular system to realize this, if it is necessary to accelerate the transmission speed in each wireless zone, for this reason a millimeter wave etc. is used, that special feature to a wireless zone will become narrow. By becoming narrow, the handover at the time of migration of a wireless terminal comes to arise frequently.
[0007] At the time of a handover, in order to change the wireless zone where a wireless terminal belongs, it is necessary to change the connection of a cable system who is transmitting information to the base station which takes charge of the wireless zone. In order for this change to take time amount, communicative hits arise. It not only reduces communication link quality, but these hits reduce the transmission efficiency in a cable network by a lot of resending, when a lot of information is being transmitted to the high speed. A handover arises from the above-mentioned reason frequently, so that a wireless zone becomes narrow, and hits occur frequently.

[0008] By the approach of setting up the connection to a base transceiver station who takes charge of the wireless zone of a migration place from a transmit terminal after detecting the wireless zone of a migration place like before, in order to make it a wireless zone not produce hits under a narrow situation, it is necessary to perform a connection setup at a high speed very much. This originates in the time amount belonging to one wireless zone becoming short, if the wireless terminal is moving in the inside of a narrow wireless zone. However, since it becomes the situation that there are no allowances in a band when the base transceiver station is held in the network which has also served the communication link of cable terminals, the time amount which a connection setup takes in addition to the latency time until a band is vacant is needed, and a situation with it very difficult [to perform a connection setup at a high speed] may arise. Before the above-mentioned connection is set up, when a wireless terminal moves to another wireless zone, as for the wireless terminal under migration, the period of hits may become the situation of a communication interruption over long duration continuously as a result.
[0009] Moreover, even when a wireless zone is large, a phenomenon which goes back and forth between the wireless zones on the boundary produces the wireless terminal which the change boundary between wireless zones may be carrying out the complicated configuration, and moves on the boundary, and a situation which repeats a handover between short time as a result may happen. Also in such a case, the communication interruption of long duration may be caused for the same reason as the above.
[0010] Then, this invention is made in view of the above-mentioned trouble, presses down very low the possibility of the hits at the time of the handover accompanying migration of a wireless terminal, and aims at offering the network control unit which can moreover aim at the band of a cable network, and improvement in the use effectiveness of a radio channel.
[0011] That is, the probability which the above-mentioned transmit information can receive succeedingly not only in the wireless zone where the wireless terminal belongs but in the previous wireless zone where the wireless terminal moved since a connection was beforehand

secured to the base transceiver station which takes charge of two or more wireless zones which exist in the movable direction from this wireless zone and the transmit information from a transmit terminal was multicasted becomes high, and it becomes possible to make very low possibility of the hits at the time of a handover. Moreover, since the number of the wireless zones which should be carried out a multicast by using the possibility of the migration direction of the communication link quality demanded and a wireless terminal, prediction of the migration direction, and passing speed can be stopped as much as possible, the use effectiveness of the band of a cable network or a radio channel can be raised, reducing the probability of hits.

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MEANS

[Means for Solving the Problem] In case the wireless terminal in the wireless zone which two or more base transceiver stations connected to the communication network form, and the partner terminal held in said network communicate mutually, the network control unit of this invention In the network control unit which performs network control between said base transceiver station accompanying migration between the wireless zones of said wireless terminal, and said partner terminal A setting means to set up the convention field on the basis of the wireless zone where said wireless terminal belongs, A means to transmit the transmission information from a partner terminal is provided to two or more base transceiver stations which form the wireless zone belonging to the convention field set up with this setting means. Said setting means When said wireless terminal moves, by setting up a convention field by making the wireless zone of the migration place of said wireless terminal into new criteria, the possibility of the hits at the time of the handover accompanying migration of a wireless terminal is pressed down very low, and, moreover, the band of a cable network and improvement in the use effectiveness of a radio channel can be aimed at.
[0013] Moreover, in case the wireless terminal in the wireless zone which two or more base transceiver stations connected to the communication network form, and the partner terminal held in said network communicate mutually, the network control unit of this invention In the network control unit which performs network control between said base transceiver station accompanying migration between the wireless zones of said wireless terminal, and said partner terminal A setting means to set up the convention field on the basis of the wireless zone where said wireless terminal belongs, As opposed to two or more base transceiver stations which form the wireless zone belonging to the convention field set up with this setting means The 1st transmitting means which transmits the transmission information from a partner terminal, and the 2nd transmitting means which transmits the transmission information from a partner terminal to the base transceiver station which forms the wireless zone where said wireless terminal belongs, According to the demand quality of the communication link between said wireless terminals and partner terminals, a selection means to choose either is provided among said 1st transmitting means and said 2nd transmitting means. Said setting means When said wireless terminal moves, by setting up a convention field by making the wireless zone of the migration place of said wireless terminal into new criteria, the possibility of the hits at the time of the handover accompanying migration of a wireless terminal is pressed down very low, and, moreover, the band of a cable network and improvement in the use effectiveness of a radio channel can be aimed at.

[0014] Moreover, the use effectiveness of the band of a cable network or a radio channel can be raised by controlling the range which the above multicasts according to the demand quality of the communication link between a partner terminal and a wireless terminal. That is, when demand quality cannot be satisfied by hits, it is made large, and the range which the above multicasts is narrowed when that is not right.
[0015] Moreover, though natural, it depends for the method of transition between the wireless zones accompanying migration of a wireless terminal on the layout of rooms, such as office. That is, the possibility of the migration direction is decided in a private network depending on an office

layout. Office in recent years is in the environment of the layout free-lancer by organization amendment who can change a layout freely. Especially the location of a partition or a desk specifies the path where people move. The movable direction of a wireless terminal can be found out by observing the migration pattern between wireless zones for a movable direction, and saving hysteresis from this, even if it changes an office layout. Therefore, it becomes possible to use the band and radio channel of a cable network effectively by stretching the connection of a cable network only to the base transceiver station which takes charge of the wireless zone of a movable direction on the basis of the wireless zone where a wireless terminal belongs at present, and multicasting the transmit information from a transmit terminal.

[0016] Moreover, it becomes possible to reduce the probability of hits and to use the band and radio channel of a cable network effectively by observing the migration pattern of a wireless terminal, predicting the migration direction, stretching the connection of a cable network to the base transceiver station which takes charge of the wireless zone which exists in the migration direction, and multicasting the transmit information from a transmit terminal. It is possible by using the information on the possibility of the above-mentioned migration direction for this means to raise the precision of this prediction further.

[0017] Moreover, the probability of the hits at the time of a handover can be reduced by multicasting the transmit information from a transmit terminal to the wireless zone where a larger convention field is prepared to a wireless terminal with large passing speed on the basis of the wireless zone where this wireless terminal belongs, and that convention field belongs. It functions effectively that this multicasts the transmit information from a transmit terminal as many wireless zones which exist in the migration direction of a wireless terminal since the opportunity of the handover per unit time amount increases as a wireless terminal with large passing speed.

[0018] Moreover, the band and radio channel of a cable network can be effectively used for the terminal which transmits the transmit information from a transmit terminal only to the base transceiver station which takes charge of the wireless zone where the wireless terminal belongs, and moves to the wireless terminal which does not move by notifying migratory [of a wireless terminal] beforehand before communicating by preparing an above more large convention field. It is possible to fall the possibility of hits further by making passing speed notify to the wireless terminal which moves further, and deciding the range of a convention field to be such a large field that this notified passing speed be large.

[0019] The probability of hits can be sharply reduced by the multicast with the means using the possibility of the above migration direction, prediction of the migration direction, and passing speed. Although the wireless terminal which moves will use many network resources with this means By narrowing an usable band to a wireless terminal with large passing speed, and making an usable band large to a wireless terminal with conversely small passing speed It becomes possible to maintain the fairness of network resource use among the users who stop with the user who uses a wireless terminal and use a wireless terminal, moving. Moreover, it is making communication link quality low to a wireless terminal with large passing speed as another means, and making communication link quality high to a wireless terminal with conversely small passing speed. While aiming at a deployment of the band of a cable network, it becomes possible to hold the fairness of network resource use between the user who uses a wireless terminal, a low speed, or the user who stops and uses a wireless terminal, moving to a high speed.

[0020] Furthermore, it originates in the change boundary between wireless zones carrying out the complicated configuration, and the following effectiveness is acquired by the means of this invention also to the situation that the wireless terminal which moves on the boundary repeats a handover between short time. That is, it becomes possible by multicasting the information from a transmit terminal to prevent the hits by this handover repeated to the wireless zone which forms this boundary at least.

[0021]

[Embodiment of the Invention] The operation gestalt of this invention is explained with reference to a drawing.

(1st operation gestalt) Drawing 1 shows roughly the configuration of the whole communication

network concerning the 1st operation gestalt.
[0022] In drawing 1 , it connects so that it can communicate mutually through the exchange 230, and two or more base transceiver stations 201-227 (drawing 1 shows some base transceiver stations of them) and radio control offices 233 constitute the network. Here, the exchange 230 is the ATM (Asynchronous Transfer Mode) exchange and uses as an ATM network the network which connects a base transceiver station.
[0023] Each base transceiver stations 201-227 form the wireless zones 1-27, respectively. Now, the situation of receiving the transmit information from the terminal 231 by which the wireless terminal 232 was connected to the exchange 230 is considered.
[0024] The radio control station 233 has memorized the information that the wireless terminal 232 exists in the wireless zone 14. Furthermore, the radio control office 233 is memorized as a table showing the physical relationship of all wireless zones in below-mentioned drawing 5 , and controls the exchange 230 to stretch a connection so that the transmit information from a transmit terminal 131 can be multicasted from a cable network to the wireless zone 14 and the wireless zones 8, 9, 15, 20, 19, and 13 around it. That is, as shown in drawing 1 , the transmit information from a transmit terminal 231 is multicasted to base transceiver stations 214, 208, 209, 215, 220, 219, and 213 by the exchange 230, and these base transceiver stations carry out the radio transmission of the transmit information to the wireless zones 14, 8, 9, 15, 20, 19, and 13 which each takes charge of.
[0025] Two or more wireless zones which multicast the transmit information from a terminal 231 through a base transceiver station are made to call it a convention field here. With reference to drawing 2 , it explains to a detail further.
[0026] Drawing 2 shows signs that the whole region of the square room surrounded by the wall 300 is covered with the wireless zones 1-27 where 27 base transceiver stations 201-227 of drawing 1 correspond. Moreover, the wireless zone by which a multicast is carried out in case the wireless terminal 232 exists in the wireless zone 14 is expressed with the circle of a thick wire. That is, the field expressed with the circle of a thick wire is a convention field.
[0027] This multicast becomes possible by giving a copy function to the exchange 230. Since the multicast of the same information as the wireless zone 14 before migration is carried out by this even if the wireless terminal 232 moves to which surrounding wireless zone of the wireless zone 14, the hits by the handover are not produced.
[0028] now, as shown in drawing 3 , when 232 moves to the wireless zone 15 from the wireless zone 14 in the end of a non-tip The base transceiver station is supervising the receive state of the electric wave sent out from the wireless terminal 232, notify it to the radio control station 233, and it detects that the wireless terminal moved the radio control station 233 to the wireless zone 15. The exchange 230 is controlled to stretch a connection so that the transmit information from a terminal 231 can be multicasted as the surrounding wireless zones 9, 10, 16, 21, 20, and 14 of the wireless zone 15 from a cable network. This prepares for migration of the next time of the wireless terminal 232. In addition, in drawing 3 , the same sign is given to the same part as drawing 1 , and explanation is omitted.
[0029] A convention field when the wireless terminal 232 moves to the wireless zone 15 at drawing 4 is shown. In addition, in drawing 4 , the same sign is given to the same part as drawing 2 , and explanation is omitted. At drawing 4 , the wireless zone by which a multicast is carried out when the wireless terminal 232 moves to the wireless zone 15 is expressed with the circle of a thick wire.
[0030] The radio control station 233 is controlling by repeating such a procedure with migration of a wireless terminal to multicast the transmit information from the partner terminal 231 to the wireless zone where a wireless terminal always belongs and the surrounding wireless zone of the wireless zone, i.e., a convention field.
[0031] In the case of the above-mentioned multicast connection control, it carries out with reference to a table as shown in drawing 5 managed in the radio control office 233. In addition, in drawing 5 , ID of the base transceiver station which forms drawing 2 and each wireless zones 1-27 of drawing 4 is set to 1-27, respectively, and ID of the base transceiver station of the near is memorized corresponding to each of a base transceiver station ID.

[0032] The radio control station 233 can pinpoint the base transceiver station which should carry out the multicast of to which wireless zone a wireless terminal belongs from this table if it pursues and ID of that wireless zone becomes clear.
[0033] For example, the base transceiver station near the base transceiver station 314 of ID14 is a base transceiver station of ID 8, 9, 15, 20, 19, and 13, and if this table is referred to, a convention field in case the wireless terminal 232 exists in the wireless zone 14 will serve as the wireless zones 8, 9, 15, 20, 19, and 13 which base transceiver stations 208, 209, 215, 220, 219, and 213 form.
[0034] This invention functions effectively, also when the base transceiver station change boundary between wireless zones is complicated, as shown in drawing 6 . This change boundary is judged as mentioned above, for example with the reinforcement of the signal power which a wireless terminal receives from a base transceiver station. With the directivity of a surrounding body or the antenna of a base transceiver station etc., this change boundary may become complicated, as shown in drawing 6 . For example, when it follows and a wireless terminal moves the path of the arrow head shown in drawing 6 , the probability to wander from place to place with the wireless zones 36, 30, 36, and 30, for 4 times of handovers to be performed sequentially from the wireless zone 30, and for hits to happen becomes high. If it may go in this path, between short time, further many handovers will be performed and the probability of hits will become higher.
[0035] According to this operation gestalt, also in such a situation, it is solved easily. That is, like the above-mentioned, when a wireless terminal is in the wireless zone 30, with reference to the table shown in drawing 5 , the radio control office 233 sets up the convention field which consists of a wireless zone 30 used as criteria, and wireless zones 31, 32, 33, 34, 35, and 36 of that near, and multicasts the transmit information from a transmit terminal to the base transceiver station of this convention field. Similarly, when a wireless terminal is in the wireless zone 36, the convention field which consists of a wireless zone 36 used as criteria and wireless zones 38, 31, 30, 35, 36, and 37 of that near is set up, and the transmit information from a transmit terminal is multicasted to the base transceiver station of this convention field.
[0036] Thus, as mentioned above, even if it is in the situation which carries out the handover of the wireless zones 30 and 36, since the multicast of the transmit information from a transmit terminal is carried out to these wireless zones 30 and 36, hits will be produced.
[0037] The ATM network which connects between the base transceiver stations used with this operation gestalt can offer service of various transmission speed and communication link quality. With an ATM network, it transmits as a packet which added 5 bytes of header which divided transmit information per 48 bytes and wrote in the transmitting destination etc. This packet is called a cel. Communication link quality is expressed by the waste ratio of arrival delay of this cel, or a cel.
[0038] With an ATM network, the class classified according to the transmission speed of a cel and communication link quality is prepared, and a user communicates by choosing a desired communication link class. For example, if it is extent which can recognize as voice in the case of voice communication, and can understand the contents to it, since a cel may be discarded somewhat, the desired value to a cel waste ratio is low. However, since real time nature is required in order to talk with voice, the demand about delay becomes severe. That is, in the case of voice communication, the allowed value of a waste ratio will be large and will choose the small communication link class of the allowed value of delay. Although the desired value to a cel waste ratio is severe on the other hand in order to avoid a lot of resending by data communication especially in the case of high-speed transmission, the demand about delay is loose. Therefore, in this case, the allowed value of a waste ratio will be small and will choose the large communication link class of the allowed value of delay. Thus, it is one description of an ATM network that communication link quality can be chosen according to the communicative contents.
[0039] furthermore -- an ATM network -- voice -- like -- a cel waste ratio -- receiving -- tolerance -- being also large -- it is alike, and it receives and tolerance is usually large also to hits. In such a case, it does not multicast to two or more above wireless zones, but the

information from a transmit terminal is transmitted only to the wireless zone where a wireless terminal belongs. On the contrary, when the tolerance to hits is a severe communication link, the multicast to two or more wireless zones is performed as mentioned above, and the probability for hits to arise is reduced.

[0040] In case the radio control station 233 sets up a connection between a partner terminal and a wireless terminal, specifically the demand parameter (for example, a permission cel loss ratio --) of the communication link quality beforehand notified by the user Based on permission cel transfer delay time amount etc., either of the transmission only to the multicast to the convention field which consists of a wireless zone where a wireless terminal belongs, and a wireless zone of the near, and the wireless zone where a wireless terminal belongs is chosen.

[0041] By performing such a selection control, it becomes possible to use the band and radio channel of an ATM network effectively. As explained, according to the operation gestalt of the above 1st, as mentioned above, the radio control station 233 As opposed to two or more base transceiver stations which take charge of the wireless zone which prepares the convention field on the basis of the location of the wireless zone where the wireless terminal 232 belongs, and belongs to this convention field As opposed to two or more base transceiver stations which take charge of the wireless zone which multicasts, establishes the convention which made the wireless zone of a migration place new criteria when [which transmits the transmission information from a transmit terminal 231] the wireless terminal 232 moves, and belongs to this convention field By transmitting the transmission information from a transmit terminal 231 by the multicast Since a connection is beforehand secured to the base transceiver station which takes charge not only of the wireless zone where the wireless terminal belongs but of two or more wireless zones which exist in the movable direction from this wireless zone and the transmit information from a transmit terminal is multicasted, The probability which the above-mentioned transmit information can receive succeedingly also in the previous wireless zone where the wireless terminal moved becomes high, and it becomes possible to make very low possibility of the hits at the time of a handover.

[0042] Moreover, the radio control station 233 receives two or more base transceiver stations which take charge of the wireless zone which prepares the above-mentioned convention field on the basis of the location of the wireless zone where the wireless terminal 232 belongs, and belongs to this convention field. Either of whether the transmission information from a transmit terminal 231 is transmitted to the base transceiver station which takes charge of the wireless zone where whether the transmission information from a transmit terminal 231 being transmitted and the wireless terminal 232 belong Since the number of the wireless zones which should be carried out a multicast by choosing according to the demand quality of the communication link beforehand notified between the transmit terminal 231 and the wireless terminal 232 can be stopped as much as possible, The use effectiveness of the band of a cable network or a radio channel can be raised reducing the probability of hits.

[0043] Furthermore, it becomes possible to prevent the hits by this handover repeated by originating in the change boundary between wireless zones carrying out the complicated configuration, and multicasting the information from a transmit terminal to the wireless zone which forms this boundary at least also to the situation that the wireless terminal which moves on that boundary repeats a handover between short time.

[0044] (2nd operation gestalt) With reference to drawing 7 , the principle of the 2nd operation gestalt of this invention is explained first. Drawing 7 shows signs that radio-transmission service is performed in the wireless zones 1-27 to the room where the path 301 was set as the room surrounded by the wall 300 by layout modification like drawing 2 . Places other than path 301 presuppose that the desk is set up. In this case, what it may move frequently at is a path 301, and the circumference of a desk has large possibility of stopping and using it. The wireless zone where a wireless terminal belongs changes with migration of a wireless terminal, and this is dependent on the layout of such a room, though natural.

[0045] Office in recent years can make now a layout change by organization amendment etc. freely by the appearance of a dismountable partition etc. If a wireless zone covers the whole room as shown in drawing 7 , it will become as [be / radio-transmission service / in the whole

region / possible], and it can respond to various layouts in such office changed occasionally.
[0046] In order to prevent the hits by the handover as much as possible by such office environment, using the band and radio channel of the cable section effectively, the technique of the 2nd operation gestalt of searching for the possibility of transition between the wireless zones of a wireless terminal by observation is very effective.
[0047] Although the convention field was prepared with the 1st above-mentioned operation gestalt so that hits might not arise even if the wireless terminal 232 moved in which direction in the future On the other hand, it observes and asks for transition between the wireless zones according the movable direction of the wireless terminal 232 to the past handover with the 2nd operation gestalt. The wireless zone with the wireless zone where a wireless terminal belongs multicasts the transmit information from a transmit terminal to the wireless zone which exists in the movable direction. Since the number of the wireless zones multicasted by this, preventing hits can be reduced, a band can be used effectively also not only on a cable part but on a radio-transmission way.
[0048] Next, a means to search for the movable direction of the wireless terminal 232 is explained concretely. Here, the ID number for distinguishing 27 wireless zones presupposes that it is the same as that of the sign given to the wireless zone shown in drawing 7 . Moreover, if it shall have memorized as a table showing the physical relationship of all wireless zones in drawing 5 , since the radio control office 233 is the maximum 6 of the number of each wireless zone to movable adjoining wireless zones, it can express the transition between wireless zones with the matrix Gposs of 27x6 of a degree type (1).
[0049]
[Equation 1]

$$G_{poss}=\begin{bmatrix} g_{1,1} & g_{1,2} & g_{1,3} & \cdots & g_{1,6} \\ g_{2,1} & g_{2,2} & g_{2,3} & \cdots & g_{2,6} \\ g_{3,1} & g_{3,2} & \ddots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \ddots & g_{26,6} \\ g_{27,1} & g_{27,2} & \cdots & g_{27,5} & g_{27,6} \end{bmatrix} \quad \cdots (1)$$

[0050] Here, initial value of each element gij of Matrix Gposs is set to "0." Although the number i of each line expresses the ID number of a wireless zone, the element of each line is equivalent to the element of the wireless zone ID which each line of the table shown in drawing 5 shows. for example, the wireless zone where the party eye of Gposs can change from the wireless zone of ID number 1 -- being shown -- **** -- the table of drawing 5 -- following -- g -- 1 and 1 the transition to the wireless zone 2 from the wireless zone 1, and g -- 1 and 2 the transition to the wireless zone 7 from the wireless zone 1, and g -- 1 and 3 The transition to the wireless zone 6 from the wireless zone 1 is expressed. since the adjoining wireless zone which can change from the wireless zone 1 is only three [more than] -- g -- 1 and 4g -- 1 and 5g -- 1 and 6 Initial value is maintained in this case and it is set to "0" so that it may not have semantics but the following explanation may show.
[0051] Matrix Gposs sets the element gij showing transition between wireless zones as "1", when transition arises between wireless zones. For example, if drawing 7 is considered for an example, a path 301 is located in the room of this drawing, and since a wireless terminal is movable only at this path, Matrix Gposs will become like a degree type (2).
[0052]
[Equation 2]

$$G_{poss}=\begin{bmatrix}
0&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&1&0&1&0\\
0&0&1&0&0&1\\
0&0&1&0&0&1\\
0&0&1&0&0&1\\
0&0&0&0&0&1\\
0&1&0&1&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0
\end{bmatrix} \quad \cdots (2)$$

[0053] While a wireless terminal actually moves, whenever it communicates by such processing, it gains as possible transition between wireless zones. This becomes a pattern reflecting the layout of the room in order to give movable transition of a wireless terminal. It becomes possible to use the band and radio channel of a cable network effectively by multicasting the information from a transmit terminal only to the possible wireless zone of transition based on the transition information between wireless zones as shown in this gained formula (2).

[0054] Although the convention field which is specifically set up to the wireless terminal 232 which exists in the wireless zone 14 in the case of the 1st above-mentioned operation gestalt serves as the wireless zone 14 and the wireless zones 8, 9, 15, 20, 19, and 13 around it Since existence of a path 301 can be grasped using transition information like a formula (2) in the case of the 2nd operation gestalt, a convention field serves as the wireless zones 14, 13, and 15. Therefore, when these are compared, it turns out easily that the number of the wireless zones which multicast the transmit information from the partner terminal 231 can be limited more.

[0055] As mentioned above, as explained, according to the operation gestalt of the above 2nd, the transition hysteresis between the wireless zones in migration of the wireless terminal 232 is memorized. It becomes possible to use the band and radio channel of a cable network effectively by searching for the movable direction of a migration terminal from this memorized transition hysteresis information, and preparing the convention field on the basis of the location of the wireless zone where the wireless terminal 232 belongs in this movable direction.

[0056] (3rd operation gestalt) With the 3rd operation gestalt, it is characterized by observing the frequency of transition between the wireless zones where a wireless terminal belongs, and securing and multicasting a band preferentially to a wireless zone with much this frequency that changes. Thereby, it aims at lowering the probability of hits, making effectively the most of the band and radio channel of a cable network.

[0057] Next, a means to observe the frequency of transition of a wireless zone where the wireless terminal 232 belongs, and to predict the migration direction is concretely explained with reference to drawing 7 . Here, the ID number for distinguishing 27 wireless zones presupposes that it is the same as that of the number of the wireless zone shown in drawing 7 like the 2nd example. Moreover, if it shall have memorized as a table showing the physical relationship of all wireless zones in drawing 5, since the radio control office 233 is the maximum 6 of the number of each wireless zone to movable adjoining wireless zones, it can express the frequency of transition between wireless zones with the matrix S of 27x6 of a degree type (3).

[0058]

[Equation 3]

$$S=\begin{bmatrix} s_{1,1} & s_{1,2} & s_{1,3} & \cdots & s_{1,6} \\ s_{2,1} & s_{2,2} & s_{2,3} & \cdots & s_{2,6} \\ s_{3,1} & s_{3,2} & \ddots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \ddots & s_{26,6} \\ s_{27,1} & s_{27,2} & \cdots & s_{27,5} & s_{27,6} \end{bmatrix} \quad \cdots (3)$$

[0059] Here, initial value of each element Sij of Matrix S is set to "0." Although the number i of each line expresses the ID number of a wireless zone, the element of each line is equivalent to the element of the wireless zone ID which each line of the table shown in drawing 5 shows. for example, the wireless zone where the party eye of Matrix S can change from the wireless zone of an ID number "1" -- being shown -- **** -- the table of drawing 5 -- following -- S -- 1 and 1 the transition to the wireless zone 2 from the wireless zone 1, and S -- 1 and 2 the transition to the wireless zone 7 from the wireless zone 1, and S -- 1 and 3 The transition to the wireless zone 6 from the wireless zone 1 is expressed. since the adjoining wireless zone which can change from the wireless zone 1 is only three [more than] -- S -- 1 and 4S -- 1 and 5S -- 1 and 6 Initial value is maintained in this case and it is set to "0" so that it may not have semantics but the following explanation may show.

[0060] Matrix S adds "1" to the element Sij showing transition between wireless zones, when transition arises between wireless zones. By repeating this processing, a place with much transition serves as a big value. For example, if drawing 7 is considered for an example, since a path 301 is located in the room of this drawing and a wireless terminal is movable only at this path, Matrix S becomes like for example, a degree type (4).

[0061]

[Equation 4]

$$S=\begin{bmatrix}
0&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
9&0&9&0&1&0\\
0&0&9&0&0&7\\
0&0&9&0&0&5\\
0&0&2&0&0&1\\
0&0&0&0&0&1\\
0&1&0&1&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0
\end{bmatrix} \quad \cdots (4)$$

[0062] While a wireless terminal actually moves, whenever it communicates by such processing, the frequency of transition between wireless zones is gained. Using the frequency information on transition between wireless zones like this gained formula (4), the previous wireless zone where a wireless terminal moves can be predicted. That is, since it is thought that the probability for a wireless terminal to move to a wireless zone with much frequency of transition is high, it becomes possible by securing a band preferentially and multicasting the information from a transmit terminal to use effectively the band of a cable-transmission way and a radio-transmission way.

[0063] Since the convention field specifically set up to the wireless terminal 232 which exists in the wireless zone 14 can grasp existence of a path 301 using transition information like a formula (2) in the case of the 2nd operation gestalt, it serves as the wireless zones 14, 13, and 15. the case of the 3rd operation gestalt -- a basis [information / on transition like a formula (4) / frequency] -- the element s of Matrix S -- the value of 14 and 15 -- s -- decision of being larger than the value of 14 and 13, i.e., the transition frequency from the wireless zone 14 to the wireless zone 15 being higher, sets up a convention field with the wireless zones 14 and 15. In other words, although the convention field of the wireless terminal 232 which exists in the wireless zone 14 in the case of the 2nd operation gestalt may serve as a wireless zone before and behind the wireless zone 14 along a path 301, it turns out that it can limit to the wireless zone 14 and 15 where the possibility of migration transition is further more high, for example, wireless zones, according to the 3rd operation gestalt.

[0064] As explained above, according to the operation gestalt of the above 3rd, the frequency of transition between the wireless zones in migration of the wireless terminal 232 is memorized. By predicting the migration direction of a migration terminal from this memorized transition hysteresis information, and making the above-mentioned convention field on the basis of the

location of the wireless zone where the wireless terminal 232 belongs into the field which exists in that migration direction It becomes possible to reduce the probability of hits and to use the band and radio channel of a cable network effectively.
[0065] Furthermore, by using the information on the possibility of the migration direction of the 2nd operation gestalt (formula (2)), the precision of this prediction can be raised and the range of a convention field can be made small.
(4th operation gestalt) With the 4th operation gestalt of this invention, the migration direction and passing speed of a wireless terminal are measured, and the transmit information from a transmit terminal is multicasted to many wireless zones which exist in the migration direction, so that passing speed is large. Thereby, since the band of the cable section to a base transceiver station is securable early, it becomes possible to lessen the probability of hits.
[0066] What is necessary is to observe this updating timing and just to measure the transition direction and the transition rate to coincidence, although "1" is added and updated by the element corresponding to the time of transition between the wireless zones of each element of the matrix S of a formula (3) in order to realize this. The wireless zone which performs a multicast according to the magnitude of this rate is determined.
[0067] With reference to drawing 8 and drawing 9 , it explains concretely. In addition, drawing 8 and drawing 9 show signs that radio-transmission service is performed in the wireless zones 1-27 to the room where the path 301 was set as the room surrounded by the wall 300 by layout modification like drawing 7 like drawing 2 . Moreover, suppose that the movable direction of the wireless terminal explained with the 2nd operation gestalt, i.e., the direction along a path 301, is already searched for.
[0068] For example, as shown in drawing 8 , when the wireless terminal 232 is in the wireless zone 13 and it is moving in the direction of the arrow head of this drawing at a low speed, the transmit information from a transmit terminal 231 is multicasted as the wireless zones 13 and 14 (circle of the thick wire of this drawing). On the other hand, as drawing 9 shows, when the wireless terminal 232 gets down to the wireless zone 13 and it is moving in the direction of the arrow head of this drawing further at high speed, the transmit information from a transmit terminal 231 is multicasted as the wireless zones 13, 14, and 15 (circle of the thick wire of this drawing).
[0069] In order that the radio control station 233 may set up the range of a convention field according to the passing speed of a wireless terminal, the radio control station 233 specifically When having memorized as a table as shows the physical relationship of all wireless zones to drawing 5 , in case the wireless terminal 232 moves dynamically with reference to this between wireless zones, you may make it set up the range of the convention field for low speeds, and the convention field for high speeds. When the wireless terminal 232 exists in the wireless zone 13 and it is detected that the migration direction is a direction shown by the arrow head of drawing 8 , namely, the range of a convention field in case passing speed is a low speed Since it is good only in the wireless zone by the side of recently which exists in the migration direction of the wireless terminal 232 along the path 301 beforehand detected on the basis of the wireless zone 13, it can set up with the wireless zone 14 immediately from drawing 5 . Since it is necessary to ask for the range of a convention field still more broadly than the wireless zone by the side of recently [of the wireless zone used as criteria] on the other hand when passing speed is a high speed, First, the inside of the recently side base transceiver station of the table of drawing 5 to the base transceiver station ID "13", The recently side base transceiver station ID of the wireless zone which exists in the migration direction of the wireless terminal 232 along a path 301 "14" is obtained. Next, the base transceiver station ID "15" of the wireless zone which exists in the migration direction of the wireless terminal 232 which was along a path 301 among the recently side base transceiver stations of a base transceiver station ID "14" is gained from the table of drawing 5 . Thereby, a convention field when the passing speed of the wireless terminal 232 which exists in the wireless zone 13 is high-speed serves as the wireless zones 13, 14, and 15.
[0070] Moreover, you may make it provide the table showing the range of the convention field for low speeds as shown in drawing 5 , for example, and the table showing the range of the

convention field for high speeds which memorized the base transceiver station ID soon still more broadly than it, respectively.
[0071] Furthermore, when the movable direction of the wireless terminal explained with the 2nd operation gestalt, i.e., the direction along a path 301, is searched for, [for example,] The range of the convention field the object for low speeds and for high speeds is gained, and you may make it memorize the range of the passing speed's result convention-field in the case of [each] a low speed and a high speed as a table dynamically with reference to the table shown for mentioning above at drawing 5 .
[0072] Now, as shown in drawing 10 , the wireless terminal 232 is moving in the direction of an arrow head, and the situation that moving to the wireless zone 15 via the wireless zone 14 is expected is considered from the wireless zone 13 where the wireless terminal 232 belongs. While the wireless terminal 232 moves in the wireless zones 13 and 14, although the base transceiver stations 213 and 214 which take charge of these wireless zones are held in the exchange 250, the base transceiver station 215 of the wireless zone 15 which is the following migration place serves as the different exchange 251. In this case, it will be necessary to change the exchange and that change will take time amount.
[0073] Then, when the migration direction and passing speed of the wireless terminal 232 are detected by the radio control station 233 with migration of the wireless terminal 232, When the change of the exchange is expected with reference to the table which expressed further the relation of the exchange which holds a base transceiver station and it about the base transceiver station of the wireless zone which exists in the migration direction of the wireless terminal 32, as shown in drawing 10 When the wireless terminal 232 of the radio control station 233 is in the wireless zone 13, it secures the band of the cable network to the exchange which connects the base transceiver station 215 which forms the wireless zone 15 a little early. Thereby, the probability of hits can be made low.
[0074] As mentioned above, as explained, according to the operation gestalt of the above 4th, it asks for the migration direction and passing speed of a migration terminal from renewal of the transition hysteresis between the wireless zones in migration of a wireless terminal. It becomes possible to reduce the probability of hits and to use the band and radio channel of a cable network effectively by changing the convention field on the basis of the location of the wireless zone where the wireless terminal 232 belongs according to the migration direction and passing speed of this wireless terminal. ****** of a convention field can be made still smaller by using the information on the possibility of the migration direction of the 2nd operation gestalt (formula (2)) for this means.
[0075] Moreover, the probability of the hits at the time of a handover can be reduced by multicasting the transmit information from a transmit terminal to the wireless zone where a larger convention field is prepared to a wireless terminal with large passing speed on the basis of the wireless zone where this wireless terminal belongs, and that convention field belongs. It functions effectively that this multicasts the transmit information from a transmit terminal as many wireless zones which exist in the migration direction of a wireless terminal since the opportunity of the handover per unit time amount increases as a wireless terminal with large passing speed.
[0076] Furthermore, when it is predicted that the exchange to which the base transceiver station in which the wireless terminal is held at present is connected differs from the exchange to which the base transceiver station in which the wireless zone of a future migration place is held is connected, the probability of the hits at the time of a handover can be reduced by securing the band of the latter exchange so that it can transmit to the base transceiver station in which the transmit information of a transmit terminal holds the latter wireless zone.
[0077] (5th operation gestalt) With the 5th operation gestalt of this invention, it notifies whether it is used while the user who uses the wireless terminal 232 moves the wireless terminal 232 to be used from now on, or it is used to a call connection demand, stopping. When the use to suspend is notified, the transmit information from a transmit terminal is transmitted only to the wireless zone 14 (circle of the thick wire of this drawing) where the wireless terminal 232 belongs as drawing 11 shows. When use while moving is notified, as drawing 12 shows, the

transmit information from a transmit terminal is transmitted to the wireless zone 14 and (for example, the path 301 which may serve as a migration place as the 2nd operation gestalt explained was met) the wireless zones 13 and 15 (circle of the thick wire of this drawing) where a wireless terminal with translatability belongs. Moreover, when passing speed is notified when moving is notified, and quick passing speed is notified, as the 4th operation gestalt explained, the transmit information from a transmit terminal is multicasted to the wireless zone covering the large range rather than the case where low passing speed is notified. For example, supposing drawing 12 shows the case of a low speed, when quick passing speed is notified, it will perform the above-mentioned multicast to more wireless zones (circle of the thick wire of this drawing) like drawing 13 .

[0078] If the case of the arrival-of-the-mail sequence to the wireless terminal 232 is taken for an example and it explains concretely, first, the wireless terminal 232 which is performing the waiting receptacle will receive the arrival-of-the-mail message transmitted from a base transceiver station, and will detect arrival of the mail. The terminal which detected arrival of the mail establishes the link channel of wireless like the time of dispatch, next establishes a layer 2, after that, with the control signal of a layer 3, between networks, performs management of a wireless resource, migratory, the report about circuit call connection control, and a negotiation, and establishes the service channel for a communication link. The information notified here, for example, the existence of migration, passing speed, communication link demand quality, etc. are passed to the radio control station 233 through the network which connected a base transceiver station and it. In the radio control station 233, a convention field is set up with reference to the received report information and the table provided.

[0079] Usually, when using moving the wireless terminal 232 at high speed, **** and when using the wireless terminal 232, stopping or moving on the other hand at a low speed, by what requires so high communication link quality, it seems [transmitting important data in many cases and] to be a communication link called the informational exchange using voice. That is, when using a wireless terminal, moving at high speed, moving the wireless terminal 232 at a low speed, the use band on a network may be narrower than the case where it stops and uses, and there may be communication link quality low.

[0080] So, it controls by the radio control station 233 to make it larger than the usable band which assigns the usable band of the network assigned to a wireless terminal with small passing speed based on the above-mentioned report information to a wireless terminal with large passing speed. Moreover, control which makes high communication link quality over a wireless terminal with small passing speed, and makes low communication link quality over a wireless terminal with large passing speed is performed. That is, in drawing 1 , the radio control office 233 transmits the signal which included initial entries, such as a use band and demand quality, in ATM switching system 230 in an ATM cel, and performs predetermined connection reception control by ATM switching system 230.

[0081] Thereby, it becomes possible to maintain the fairness of network resource use among the users who stop with the user who uses a wireless terminal and use a wireless terminal, moving. Moreover, it is making communication link quality low to a wireless terminal with large passing speed, and making communication link quality high to a wireless terminal with conversely small passing speed, and while aiming at a deployment of the band of a cable network, it becomes possible to hold the fairness of network resource use between the user who uses a wireless terminal, a low speed, or the user who stops and uses a wireless terminal, moving to a high speed.

[0082] As explained above, according to the 5th operation gestalt, the possibility of the hits at the time of the handover accompanying migration of a wireless terminal is pressed down very low from the above 1st, and the network control unit which can moreover aim at the band of a cable network and improvement in the use effectiveness of a radio channel can be offered.

[0083] That is, if a millimeter wave etc. is used in order that the conventional cellular system may accelerate the transmission speed in each wireless zone, the special feature to a wireless zone will become narrow. When a wireless zone becomes narrow, the handover at the time of migration of a wireless terminal comes to arise frequently. At the time of a handover, in order to

change the connection of a cable system who is transmitting information to the base transceiver station and for this change to take time amount, communicative hits arise. It not only reduces communication link quality, but these hits reduce the transmission efficiency in a cable network by resending, when a lot of information is being transmitted to the high speed. It becomes possible to reduce sharply the probability for these hits to arise, by this invention. Moreover, it becomes possible to stop with the wireless terminal which moves and to perform fair allocation of the network resource to the wireless terminal to be used. Moreover, also when a wireless zone is large, this invention functions effectively. That is, although it originates in the complicated configuration in the change boundary between wireless zones and a handover is repeated between short time, it enables this to prevent hits. In addition, it cannot be overemphasized that it is also effective to use from the above 1st, combining the 5th operation gestalt suitably.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing having shown roughly the configuration of the communication system concerning the 1st operation gestalt of this invention.
[Drawing 2] Drawing for explaining the convention field which is what showed arrangement of the wireless zone in the office which the base transceiver station of drawing 1 forms, and is set up by radio control equipment.
[Drawing 3] Drawing for explaining actuation of the communication system of drawing 1 at the time of a wireless terminal moving between wireless zones.
[Drawing 4] Drawing for explaining the convention field which is what showed arrangement of the wireless zone in the office which the base transceiver station of drawing 3 forms, and was set up by radio control equipment.
[Drawing 5] Drawing having shown one example of a table in which the physical relationship of the wireless zone provided in a radio control station was memorized.
[Drawing 6] Drawing for explaining transition between the wireless zones of a wireless terminal.
[Drawing 7] It is what showed arrangement of the wireless zone in the office concerning the 2nd operation gestalt of this invention, and the path in this office, and is for explaining the convention field set up in the direction presumed to move with the movable direction of a wireless terminal based on the transition hysteresis between the wireless zones of a wireless terminal.
[Drawing 8] Drawing for explaining the convention field set up when the passing speed of a wireless terminal is a low speed.
[Drawing 9] Drawing for explaining the convention field set up when the passing speed of a wireless terminal is a high speed.
[Drawing 10] It is drawing having shown roughly the configuration of the communication system concerning the 4th operation gestalt of this invention, and is for explaining actuation of a radio control station in case the change of the exchange is expected with migration of a wireless terminal.
[Drawing 11] Drawing for explaining the convention field in the case of suspending and using a wireless terminal.
[Drawing 12] Drawing for explaining the convention field in the case of using it, moving a wireless terminal.
[Drawing 13] Drawing for explaining the convention field in the case of using it, moving a wireless terminal at high speed.
[Drawing 14] Drawing having shown the radio structure of a system for explaining actuation of the radio control station in the conventional radio communications system.
[Description of Notations]
1-27 -- A wireless zone (wireless zone which a base transceiver station covers), 31-38 -- Wireless zone (wireless zone divided according to the change boundary line of a wireless zone), 101, 102, 103, 104, 105, 106, 107, 208, 209, 210, 213, 214, 215, 216, 219, 220, 212 -- Base transceiver station, 1a-7a [-- A wireless terminal, 300 / -- An office wall, 301 / -- 114 The path in office, 233 / -- Radio control station.] -- A wireless zone, 110, 111, 230, 250, 251 -- 112 The exchange, 231 -- 113 A transmit terminal (partner terminal), 232

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開平9－252480
(43)公開日　平成９年(1997)９月22日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ		技術表示箇所
Ｈ０４Ｑ　7/22			Ｈ０４Ｑ　7/04	Ｊ	
7/28			Ｈ０４Ｂ　7/26	１０８Ｂ	

審査請求　未請求　請求項の数12　ＯＬ　（全 16 頁）

(21)出願番号　特願平8－59814

(22)出願日　平成８年(1996)３月15日

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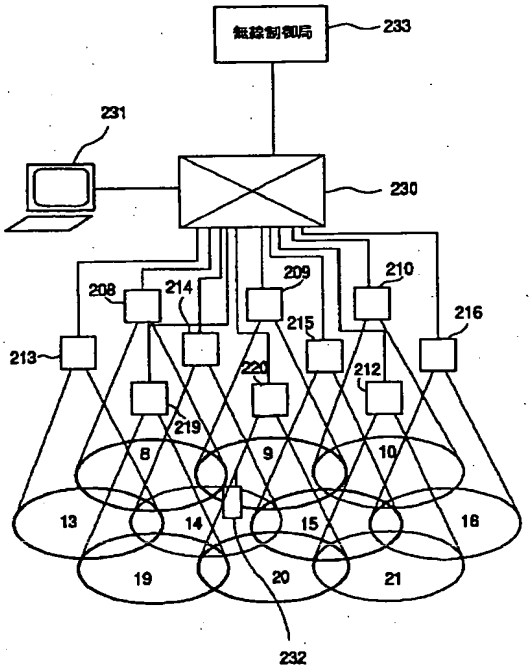
最終頁に続く

(54)【発明の名称】　網制御装置

(57)【要約】
【課題】無線端末の移動にともなうハンドオーバ時の瞬断の可能性を極めて低く押さえ、しかも有線網の帯域や無線チャネルの利用効率の向上が図れる網制御装置を提供できる。
【解決手段】無線制御局２３３は、無線端末２３２と相手端末２３１との間の通信の要求品質に応じて、無線端末２３２が属する無線ゾーン１４を基準とした規定領域を設定し、この設定された規定領域に属する無線ゾーン８、９１５、２０、１９、１３を形成する複数の無線基地局２０８、２０９、２１５、２２０、２１９、２１３に対して、相手端末２３１からの伝送情報を送信し、無線端末２３２が移動するときは、無線端末２３２の移動先の無線ゾーンを新たな基準として規定領域を設定する。



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【特許請求の範囲】

【請求項１】　通信ネットワークに接続された複数の無線基地局の形成する無線ゾーン内の無線端末と前記ネットワークに収容される相手端末とが互いに通信を行う際に、前記無線端末の無線ゾーン間の移動にともなう前記無線基地局と前記相手端末との間の網制御を行う網制御装置において、

前記無線端末が属する無線ゾーンを基準とした規定領域を設定する設定手段と、

この設定手段で設定された規定領域に属する無線ゾーンを形成する複数の無線基地局に対して、相手端末からの伝送情報を送信する手段と、

を具備し、

前記設定手段は、前記無線端末が移動するときは、前記無線端末の移動先の無線ゾーンを新たな基準として規定領域を設定することを特徴とする網制御装置。

【請求項２】　通信ネットワークに接続された複数の無線基地局の形成する無線ゾーン内の無線端末と前記ネットワークに収容される相手端末とが互いに通信を行う際に、前記無線端末の無線ゾーン間の移動にともなう前記無線基地局と前記相手端末との間の網制御を行う網制御装置において、

前記無線端末が属する無線ゾーンを基準とした規定領域を設定する設定手段と、

この設定手段で設定された規定領域に属する無線ゾーンを形成する複数の無線基地局に対して、相手端末からの伝送情報を送信する第１の送信手段と、

前記無線端末が属する無線ゾーンを形成する無線基地局に対して相手端末からの伝送情報を送信する第２の送信手段と、

前記第１の送信手段と前記第２の送信手段のうち、前記無線端末と相手端末との間の通信の要求品質に応じて、いずれか一方を選択する選択手段と、

を具備し、

前記設定手段は、前記無線端末が移動するときは、前記無線端末の移動先の無線ゾーンを新たな基準として規定領域を設定することを特徴とする網制御装置。

【請求項３】　前記設定手段は、前記無線端末と相手端末との間の通信の要求品質に応じて、前記無線端末が属する無線ゾーンを基準とした規定領域の範囲を変化することを特徴とする請求項１または２記載の網制御装置。

【請求項４】　前記無線端末の移動にともなう無線ゾーン間の遷移履歴を記憶する記憶手段をさらに具備し、

前記設定手段は、前記記憶手段で記憶された無線ゾーン間の遷移履歴を基に前記無線端末の移動可能な方向を求め、この移動可能な方向に前記無線端末が属する無線ゾーンを基準とした規定領域を設定することを特徴とする請求項１または２記載の網制御装置。

【請求項５】　前記無線端末の移動にともなう無線ゾーン間の遷移履歴を記憶する記憶手段をさらに具備し、

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前記設定手段は、前記記憶手段で記憶された無線ゾーン間の遷移履歴を基に前記無線端末の移動方向を予測し、この予測された移動方向に前記無線端末が属する無線ゾーンを基準とした規定領域を設定することを特徴とする請求項１または２記載の網制御装置。

【請求項６】　前記無線端末の移動にともなう無線ゾーンの遷移履歴を記憶する記憶手段をさらに具備し、

前記設定手段は、前記記憶手段で記憶された無線ゾーンの遷移履歴を基に、前記無線端末の移動可能な方向を求め、さらに、その移動可能な方向に沿って前記無線端末の移動方向を予測し、この予測された移動方向に前記無線端末が属する無線ゾーンを基準とした規定領域を設定することを特徴とする請求項１または２記載の網制御装置。

【請求項７】　前記無線端末の移動にともなう無線ゾーンの遷移履歴を記憶する記憶手段をさらに具備し、

前記設定手段は、前記記憶手段で記憶される無線ゾーンの遷移履歴を基に前記無線端末の移動速度を求め、その移動速度に応じて前記無線端末が属する無線ゾーンを基準とした規定領域の範囲を変化することを特徴とする請求項１または２記載の網制御装置。

【請求項８】　前記設定手段は、移動して使用すると予め申告した無線端末の規定領域の範囲を、移動して使用しないと予め申告した無線端末の規定領域の範囲より広く設定することを特徴とする請求項１または２記載の網制御装置。

【請求項９】　前記設定手段は、移動して使用すると予め申告した無線端末の規定領域の範囲を、移動して使用しないと予め申告した無線端末の規定領域の範囲より広く設定し、さらに、予め申告した移動速度が大きいほど前記無線端末の規定領域の範囲を広く設定することを特徴とする請求項１または２記載の網制御装置。

【請求項１０】　予め申告された移動速度の小さい無線端末に対して割り当てる前記通信ネットワーク上の使用可能帯域は、予め申告された移動速度の大きい無線端末に対して割り当てる使用可能帯域より広くなるよう制御することを特徴とする請求項１または２記載の網制御装置。

【請求項１１】　予め申告された移動速度の小さい無線端末に対する前記通信ネットワークの通信品質は、予め申告された移動速度の大きい無線端末に対する通信品質より高くなるよう制御すること特徴とする請求項１または２記載の網制御装置。

【請求項１２】　前記無線端末の移動にともなう無線ゾーン間の遷移履歴を記憶する記憶手段をさらに具備し、この記憶手段で記憶された無線ゾーン間の遷移履歴を基に予測される前記無線端末の移動方向および移動速度の少なくとも一方から、前記無線基地局を接続して前記通信ネットワーク上でデータ交換を行う交換機が前記無線端末の移動に伴い異なると判断されたときは、その移動

先の交換機の帯域を確保することを特徴とする請求項１または２記載の網制御装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】無線基地局を通信網で相互に接続し、無線端末を収容する通信システムにおける網制御装置に関する。

【０００２】

【従来の技術】最近、小型の携帯電話や携帯情報機器の登場により、その利便性を活かした無線によるサービスに対する期待が高まっている。一方で、有線系のＡＴＭ網では高速広帯域の通信が可能となり、これによるマルチメディア環境が構築されつつある。無線基地局をＡＴＭ網で接続し、有線系に於ける高速広帯域でのマルチメディア環境を無線系で提供することが可能となれば、無線の利便性を活かしたマルチメディア環境を構築することが可能となる。

【０００３】従来、無線系を有線系と接続する方法としてセルラーシステムが多く採用されている。これは、図１４に示すように無線サービスエリアを複数のゾーン（以後、無線ゾーンと称する）１ａ～７ａに分割してそれぞれに異なる周波数を割り当てる方式である。同じ周波数を用いている無線ゾーンが接することのない限り、他の無線ゾーンが使用している周波数を再利用することができる。これにより、無線伝送路に於ける周波数を有効利用することができる。各無線ゾーン１ａ～７ａはそれぞれ無線基地局１０１～１０７が形成する。これらの無線基地局は有線網に接続されている交換機１１０、１１１に接続されており、無線端末１１３は他の無線端末あるいは有線網に接続された端末１１２と通信を行なうことができる。

【０００４】図１４は、端末１１２から無線端末１１３へ情報を伝送している様子を示している。無線端末１１３は、どの無線ゾーンに属しているかを逐次管理されており、無線端末１１３が移動した場合には、まず、どの無線ゾーンに移動中であるかを検知する。この検知には、例えば無線基地局から送信される信号の受信状態、例えば、受信電力の強度で判定される。この受信状態は、無線制御局１１４に通知され、無線制御局１１４は移動先の無線ゾーンを担当する無線基地局にコネクションを切替える。これにより送信端末からの送信情報を伝送する。以降、無線ゾーンに於けるこの切替えの境界を、ここでは切替え領域と称することにする。

【０００５】切替えの別の手段としては、瞬断を抑えるために以下の手段がとられる。どの無線ゾーンに移動中であるかを検知した後に、移動元の無線ゾーンと移動先の無線ゾーンの境界領域では、移動元の無線ゾーンを担当する無線基地局へのコネクションを保持した状態で移動先の無線ゾーンを担当する無線基地局へのコネクションを設定して、この両コネクションを介して移動元の無線ゾーンと移動先の無線ゾーンの両方に送信端末からの送信情報を伝送する。その後、上記の切替え境界領域を越えて完全に移動先の無線ゾーンに入ったら移動元の無線ゾーンを担当する無線基地局へのコネクションを解除し、移動作の無線ゾーンのみに伝送するようになっている。

【０００６】

【発明が解決しようとする課題】有線網に於ける高品質なサービスを無線系でも実現するには、無線伝送路に於いても高速広帯域の通信を可能にする必要がある。従来のセルラーシステムでこれを実現するためには、各無線ゾーンに於ける通信速度を高速化する必要があり、このためにミリ波などを利用するとその特質から無線ゾーンが狭くなる。狭くなることにより、無線端末の移動時に於けるハンドオーバが頻繁に生じるようになる。

【０００７】ハンドオーバ時には、無線端末が属する無線ゾーンを切替えるため、その無線ゾーンを担当する基地局へ情報を伝送している有線系のコネクションを切替える必要がある。この切替えには時間を要するため、通信の瞬断が生じる。この瞬断は、通信品質を低下させるだけでなく、大量の情報を高速に伝送している場合には大量の再送により有線網に於ける伝送効率を低下させる。上記の理由から、無線ゾーンが狭くなるほどハンドオーバが頻繁に生じ、瞬断が多発する。

【０００８】従来のように移動先の無線ゾーンを検出した後に送信端末から移動先の無線ゾーンを担当する無線基地局までのコネクションを設定する方法では、無線ゾーンが狭い状況の下で瞬断を生じないようにするためにコネクション設定を非常に高速に行なう必要がある。これは、無線端末が狭い無線ゾーンの中を移動していると、１つの無線ゾーンに属する時間が短くなることに起因する。しかし、有線端末同士の通信もサービスしている網に無線基地局が収容されている場合には、帯域に余裕が無い状況になることもあり、帯域が空くまでの待ち時間に加えてコネクション設定に要する時間が必要となり、高速にコネクション設定を行なうことが非常に困難な状況が生じ得る。上記のコネクションが設定されないうちに無線端末が別の無線ゾーンに移動してしまうと、瞬断の期間が連続し、結果として長時間に渡って移動中の無線端末は通信断の状況になることがある。

【０００９】また、無線ゾーンが大きい場合でも、無線ゾーン間の切替え境界は複雑な形状をしていることがあり、その境界を移動する無線端末は、その境界上にある無線ゾーン間を往復するような現象が生じ、結果として短時間の間にハンドオーバを繰り返すような状況が起こり得る。このような場合も、上記と同じ理由により長時間の通信断を招く可能性がある。

【００１０】そこで、本発明は、上記問題点に鑑みてなされたものであり、無線端末の移動にともなうハンドオーバ時の瞬断の可能性を極めて低く押さえ、しかも有線

網の帯域や無線チャネルの利用効率の向上が図れる網制御装置を提供することを目的とする。

【００１１】すなわち、無線端末が属している無線ゾーンだけでなく、この無線ゾーンから移動可能な方向にある複数の無線ゾーンを担当する無線基地局に対して予めコネクションを確保し、送信端末からの送信情報をマルチキャストするため、無線端末が移動した先の無線ゾーンでも上記の送信情報が引続き受信できる確率が高くなり、ハンドオーバ時の瞬断の可能性を極めて低くすることが可能となる。また、要求される通信品質、無線端末の移動方向の可能性、移動方向の予測、移動速度を用いることにより、マルチキャストすべき無線ゾーンの数をできるだけ抑えることができるため、瞬断の確率を減らしつつ有線網の帯域や無線チャネルの利用効率を向上させることができる。

【００１２】

【課題を解決するための手段】本発明の網制御装置は、通信ネットワークに接続された複数の無線基地局の形成する無線ゾーン内の無線端末と前記ネットワークに収容される相手端末とが互いに通信を行う際に、前記無線端末の無線ゾーン間の移動にともなう前記無線基地局と前記相手端末との間の網制御を行う網制御装置において、前記無線端末が属する無線ゾーンを基準とした規定領域を設定する設定手段と、この設定手段で設定された規定領域に属する無線ゾーンを形成する複数の無線基地局に対して、相手端末からの伝送情報を送信する手段と、を具備し、前記設定手段は、前記無線端末が移動するときは、前記無線端末の移動先の無線ゾーンを新たな基準として規定領域を設定することにより、無線端末の移動にともなうハンドオーバ時の瞬断の可能性を極めて低く押さえ、しかも有線網の帯域や無線チャネルの利用効率の向上が図れる。

【００１３】また、本発明の網制御装置は、通信ネットワークに接続された複数の無線基地局の形成する無線ゾーン内の無線端末と前記ネットワークに収容される相手端末とが互いに通信を行う際に、前記無線端末の無線ゾーン間の移動にともなう前記無線基地局と前記相手端末との間の網制御を行う網制御装置において、前記無線端末が属する無線ゾーンを基準とした規定領域を設定する設定手段と、この設定手段で設定された規定領域に属する無線ゾーンを形成する複数の無線基地局に対して、相手端末からの伝送情報を送信する第１の送信手段と、前記無線端末が属する無線ゾーンを形成する無線基地局に対して相手端末からの伝送情報を送信する第２の送信手段と、前記第１の送信手段と前記第２の送信手段のうち、前記無線端末と相手端末との間の通信の要求品質に応じて、いずれか一方を選択する選択手段と、を具備し、前記設定手段は、前記無線端末が移動するときは、前記無線端末の移動先の無線ゾーンを新たな基準として規定領域を設定することにより、無線端末の移動にともなうハンドオーバ時の瞬断の可能性を極めて低く押さえ、しかも有線網の帯域や無線チャネルの利用効率の向上が図れる。

【００１４】また、相手端末と無線端末の間の通信の要求品質に応じて、上記のマルチキャストする範囲を制御することにより、有線網の帯域や無線チャネルの利用効率を向上させることができる。すなわち、瞬断により要求品質を満足できない場合には、上記のマルチキャストする範囲を広くし、そうでない場合には狭くする。

【００１５】また、無線端末の移動に伴う無線ゾーン間の遷移の仕方は、当然ながらオフィスなど部屋のレイアウトに依存する。すなわち、移動方向の可能性は、構内網においてはオフィスのレイアウトに依存して決まる。近年のオフィスは、組織改正による自由にレイアウトが変更可能なレイアウトフリーの環境にある。特に、パーティションや机の位置は、人が移動する道を規定するものとなる。このことから、オフィスのレイアウトを変更しても、移動可能な方向を無線ゾーン間の移動パターンを観測して履歴を保存することにより、無線端末の移動可能な方向を見い出すことができる。従って、現時点で無線端末の属する無線ゾーンを基準として、移動可能な方向の無線ゾーンを担当する無線基地局に対してのみ有線網のコネクションをはり送信端末からの送信情報をマルチキャストすることにより、有線網の帯域や無線チャネルを有効に利用することが可能となる。

【００１６】また、無線端末の移動パターンを観測し移動方向を予測し、移動方向にある無線ゾーンを担当する無線基地局に対して有線網のコネクションをはり、送信端末からの送信情報をマルチキャストすることにより、瞬断の確率を減らし、かつ、有線網の帯域や無線チャネルを有効に利用することが可能となる。この手段に、上述の移動方向の可能性の情報を用いることにより更にこの予測の精度を上げることが可能である。

【００１７】また、移動速度の大きい無線端末に対しては、この無線端末が属する無線ゾーンを基準として、より広い規定領域を設けてその規定領域の属する無線ゾーンに対して送信端末からの送信情報をマルチキャストすることでハンドオーバ時の瞬断の確率を減らすことができる。これは、移動速度の大きい無線端末ほど、単位時間当たりのハンドオーバの機会が多くなるため、無線端末の移動方向にある多くの無線ゾーンへ送信端末からの送信情報をマルチキャストすることが有効に機能するものである。

【００１８】また、予め無線端末の移動性を通信前に申告することにより移動しない無線端末にはその無線端末の属する無線ゾーンを担当する無線基地局にのみ送信端末からの送信情報を送信し、移動する端末には上述のように、より広い規定領域を設けることで有線網の帯域や無線チャネルを有効に利用できる。移動する無線端末にはさらに移動速度を申告させて、規定領域の範囲をこの

申告された移動速度が大きいほど広い領域に決めることで、更に瞬断の可能性を低下することが可能である。

【００１９】以上の移動方向の可能性、移動方向の予測、移動速度を用いた手段でマルチキャストにより瞬断の確率を大幅に低減可能である。この手段では移動する無線端末は多くの網資源を使用することになるが、移動速度の大きい無線端末に対しては使用可能な帯域を狭くし、逆に移動速度の小さい無線端末に対しては使用可能な帯域を広くすることによって、移動しながら無線端末を使用するユーザと停止して無線端末を使用するユーザとの間で網資源利用の公平性を維持することが可能となる。また、別の手段として、移動速度の大きい無線端末に対しては通信品質を低くし、逆に移動速度の小さい無線端末に対しては通信品質を高くすることで、有線網の帯域の有効利用を図るとともに、高速に移動しながら無線端末を使用するユーザと低速または停止して無線端末を使用するユーザとの間で網資源利用の公平性を保持することが可能となる。

【００２０】更に、無線ゾーン間の切替え境界が複雑な形状をしていることに起因して、その境界を移動する無線端末が短時間の間にハンドオーバを繰り返すような状況に対しても、本発明の手段により以下の効果が得られる。すなわち、少なくともこの境界を形成する無線ゾーンに対して、送信端末からの情報をマルチキャストすることにより、この繰り返されるハンドオーバによる瞬断を防止することが可能となる。

【００２１】

【発明の実施の形態】本発明の実施形態について、図面を参照して説明する。

（第１の実施形態）図１は、第１の実施形態に係る通信ネットワークの全体の構成を概略的に示したものである。

【００２２】図１において、複数の無線基地局２０１～２２７（図１では、そのうちの一部の無線基地局を示している）および無線制御局２３３は、交換機２３０を介して互いに通信可能なように接続されて、ネットワークを構成している。ここでは、交換機２３０はＡＴＭ（Ａｓｙｎｃｈｒｏｎｏｕｓ　Ｔｒａｎｓｆｅｒ　Ｍｏｄｅ）交換機であり、無線基地局を接続するネットワークはＡＴＭ網とする。

【００２３】各無線基地局２０１～２２７は、それぞれ、無線ゾーン１から２７を形成している。今、無線端末２３２が交換機２３０に接続された端末２３１からの送信情報を受信する状況を考える。

【００２４】無線制御局２３３は、無線端末２３２が無線ゾーン１４に存在するという情報を記憶している。さらに、無線制御局２３３は全ての無線ゾーンの位置関係を、例えば、後述の図５に示すテーブルとして記憶しており、無線ゾーン１４及びその回りの無線ゾーン８、９、１５、２０、１９、１３に対して送信端末１３１からの送信情報を有線網からマルチキャスト可能なようにコネクションを張るように交換機２３０を制御するようになっている。すなわち、図１に示すように、送信端末２３１からの送信情報は、交換機２３０によって無線基地局２１４、２０８、２０９、２１５、２２０、２１９、２１３に対してマルチキャストし、これらの無線基地局はそれぞれが担当する無線ゾーン１４、８、９、１５、２０、１９、１３へ送信情報を無線伝送する。

【００２５】端末２３１からの送信情報を無線基地局を介してマルチキャストする複数の無線ゾーンをここでは、規定領域と呼ぶことにする。図２を参照してさらに詳細に説明する。

【００２６】図２は、壁３００に囲まれた四角い部屋の全域が、図１の２７個の無線基地局２０１～２２７が相当する無線ゾーン１～２７によって覆われている様子を示している。また、無線ゾーン１４に無線端末２３２が存在する場合のマルチキャストされる無線ゾーンを太線の円で表している。すなわち、太線の円で表された領域が規定領域である。

【００２７】このマルチキャストは、交換機２３０にコピー機能を持たせることにより可能となる。これにより、無線端末２３２が無線ゾーン１４の回りのどの無線ゾーンへ移動しても移動前の無線ゾーン１４と同一情報がマルチキャストされているので、ハンドオーバによる瞬断は生じることがない。

【００２８】さて、図３に示すように、無先端末２３２が無線ゾーン１４から無線ゾーン１５に移動した場合には、無線基地局が無線端末２３２から送出される電波の受信状態を監視しており、それを無線制御局２３３に通知し、無線制御局２３３は無線端末が無線ゾーン１５に移動したことを検出して、無線ゾーン１５の回りの無線ゾーン９、１０、１６、２１、２０、１４に端末２３１からの送信情報を有線網からマルチキャスト可能なようにコネクションを張るように交換機２３０を制御する。これにより、無線端末２３２の次回の移動に備える。なお、図３において、図１と同一部分には同一符号を付し、説明は省略する。

【００２９】図４に、無線端末２３２が無線ゾーン１５に移動した場合の規定領域を示す。なお、図４において、図２と同一部分には同一符号を付し、説明は省略する。図４では、無線ゾーン１５に無線端末２３２が移動した場合のマルチキャストされる無線ゾーンを太線の円で表している。

【００３０】無線制御局２３３は、このような手順を無線端末の移動と共に繰り返すことにより、常に無線端末が属する無線ゾーン及びその無線ゾーンの回りの無線ゾーン、すなわち、規定領域に対して相手端末２３１からの送信情報をマルチキャストするよう制御をおこなっている。

【００３１】上記のマルチキャストコネクション制御の

際には、無線制御局２３３にて管理される図５に示すようなテーブルを参照して行うようになっている。なお、図５では図２、図４の各無線ゾーン１～２７を形成する無線基地局のＩＤをそれぞれ１～２７とし、無線基地局ＩＤのそれぞれに対応してその近傍の無線基地局のＩＤが記憶されている。

【００３２】無線制御局２３３は、無線端末がどの無線ゾーンに属するかを追跡し、その無線ゾーンのＩＤが判明すれば、このテーブルからマルチキャストすべき無線基地局を特定できる。

【００３３】例えば、ＩＤ１４の無線基地局３１４の近傍の無線基地局は、ＩＤ８、９、１５、２０、１９、１３の無線基地局であり、このテーブルを参照すると、無線端末２３２が無線ゾーン１４に存在する場合の規定領域は、例えば、無線基地局２０８、２０９、２１５、２２０、２１９、２１３が形成する無線ゾーン８、９、１５、２０、１９、１３となる。

【００３４】本発明は、図６に示すように無線ゾーン間の無線基地局切替え境界が複雑になっている場合にも有効に機能する。この切替え境界は、例えば前述のように無線端末が無線基地局から受信する信号電力の強度によって判定されるものである。この切替え境界は、回りの物体や無線基地局のアンテナの指向性などにより、図６に示すように複雑になる可能性がある。例えば、図６に示す矢印の経路を従って無線端末が移動した場合には、無線ゾーン３０から順に、無線ゾーン３６、３０、３６、３０と渡り歩くことになり、４回のハンドオーバを行なうことになり瞬断の起こる確率が高くなる。この経路で往復するようなことがあると、短時間の間に更に多くのハンドオーバを行なうことになり、瞬断の確率がより高くなる。

【００３５】このような状況においても、本実施形態によれば容易に解決される。すなわち、前述同様に、無線端末が無線ゾーン３０にいる場合には、無線制御局２３３は、例えば、図５に示したテーブルを参照して、基準となる無線ゾーン３０と、その近傍の無線ゾーン３１、３２、３３、３４、３５、３６からなる規定領域を設定して、この規定領域の無線基地局に対し送信端末からの送信情報をマルチキャストする。同様にして、無線端末が無線ゾーン３６にいる場合には、基準となる無線ゾーン３６と、その近傍の無線ゾーン３８、３１、３０、３５、３６、３７からなる規定領域を設定して、この規定領域の無線基地局に対して送信端末からの送信情報をマルチキャストする。

【００３６】このようにして、前述したように、無線ゾーン３０、３６をハンドオーバする状況であっても、これらの無線ゾーン３０、３６に送信端末からの送信情報がマルチキャストされているので瞬断は生じないことになる。

【００３７】本実施形態で用いた無線基地局間を接続するＡＴＭ網は、様々な伝送速度および通信品質のサービスを提供可能である。ＡＴＭ網では、送信情報を４８バイト単位に分割して送信宛先などを書き込んだヘッダ５バイトを付加したパケットとして送信する。このパケットはセルと呼ばれる。通信品質は、このセルの到着遅延やセルの廃棄率によって表される。

【００３８】ＡＴＭ網では、セルの伝送速度、通信品質により分類されたクラスを設け、ユーザは所望の通信クラスを選択して通信を行なう。例えば、音声通信の場合には、音声として認識でき内容が理解できる程度なら、セルが多少廃棄されてもよいため、セル廃棄率に対する要求値は低い。但し、音声で会話を行なうためにはリアルタイム性が要求されるため、遅延に関する要求は厳しくなる。すなわち、音声通信の場合は、廃棄率の許容値が大きく、遅延の許容値の小さい通信クラスを選択することになる。一方、データ通信で特に高速伝送の場合には、大量の再送を避けるため、セル廃棄率に対する要求値は厳しいが、遅延に関する要求は緩い。よって、この場合は、廃棄率の許容値が小さく、遅延の許容値の大きい通信クラスを選択することになる。このように、通信の内容に応じて通信品質が選択できることがＡＴＭ網の一つの特徴である。

【００３９】さらに、ＡＴＭ網では、音声のようにセル廃棄率に対して許容度の大きいもに対しては、通常、瞬断に対しても許容度が大きい。このような場合には上述のような複数の無線ゾーンに対してマルチキャストせず、無線端末の属する無線ゾーンのみに送信端末からの情報を送信する。逆に、瞬断への許容度が厳しい通信の場合には上述のように複数の無線ゾーンに対するマルチキャストを行ない、瞬断の生じる確率を減らす。

【００４０】具体的には、無線制御局２３３は、相手端末と無線端末との間にコネクションを設定する際に、ユーザから予め申告された通信品質の要求パラメータ（例えば、許容セル損失率、許容セル転送遅延時間等）に基づき、無線端末の属する無線ゾーンとその近傍の無線ゾーンからなる規定領域に対するマルチキャスト、および、無線端末の属する無線ゾーンのみに対する送信のいずれか一方を選択する。

【００４１】このような選択制御を行うことにより、ＡＴＭ網の帯域および無線チャネルを有効利用することが可能となる。以上、説明したように、上記第１の実施形態によれば、無線制御局２３３は、無線端末２３２が属する無線ゾーンの場所を基準とした規定領域を設け、この規定領域に属する無線ゾーンを担当する複数の無線基地局に対して、送信端末２３１からの伝送情報を送信するマルチキャストし、無線端末２３２が移動した場合には移動先の無線ゾーンを新たな基準とした規定を設け、この規定領域に属する無線ゾーンを担当する複数の無線基地局に対して、送信端末２３１からの伝送情報をマルチキャストにより送信することにより、無線端末が属し

ている無線ゾーンだけでなく、この無線ゾーンから移動可能な方向にある複数の無線ゾーンを担当する無線基地局に対して予めコネクションを確保し、送信端末からの送信情報をマルチキャストするため、無線端末が移動した先の無線ゾーンでも上記の送信情報が引続き受信できる確率が高くなり、ハンドオーバ時の瞬断の可能性を極めて低くすることが可能となる。

【００４２】また、無線制御局２３３は、無線端末２３２が属する無線ゾーンの場所を基準とした上記の規定領域を設けてこの規定領域に属する無線ゾーンを担当する複数の無線基地局に対して、送信端末２３１からの伝送情報を送信するか、無線端末２３２が属する無線ゾーンを担当する無線基地局に対して送信端末２３１からの伝送情報を送信するかのいずれか一方を、送信端末２３１と無線端末２３２の間の予め申告された通信の要求品質に応じて選択することにより、マルチキャストすべき無線ゾーンの数をできるだけ抑えることができるため、瞬断の確率を減らしつつ有線網の帯域や無線チャネルの利用効率を向上させることができる。

【００４３】さらに、無線ゾーン間の切替え境界が複雑な形状をしていることに起因して、その境界を移動する無線端末が短時間の間にハンドオーバを繰り返すような状況に対しても、少なくともこの境界を形成する無線ゾーンに対して、送信端末からの情報をマルチキャストすることにより、この繰り返されるハンドオーバによる瞬断を防止することが可能となる。

【００４４】（第２の実施形態）まず、図７を参照して、本発明の第２の実施形態の原理を説明する。図７は、壁３００に囲まれた部屋にレイアウト変更で通路３０１が設定された部屋に、図２と同様に、無線ゾーン１～２７で無線伝送サービスを行なっている様子を示している。通路３０１以外のところは机が設定されているとする。この場合、頻繁に移動する可能性のあるのは通路３０１であり、机の周辺は停止して使用する可能性が大きい。無線端末の属する無線ゾーンは、無線端末の移動と共に遷移し、これは当然ながら、このような部屋のレイアウトに依存する。

【００４５】近年のオフィスは、取り外し可能なパーティションなどの登場により組織改正などによるレイアウト変更が自由に行なえるようになっている。図７に示すように無線ゾーンが部屋全体をカバーすれば全域で無線伝送サービスが可能なようになり、このようなオフィス内の時折変更される様々なレイアウトに対応することができる。

【００４６】このようなオフィス環境で、有線部の帯域や無線チャネルを有効に使用しつつできるだけハンドオーバによる瞬断を防ぐために、無線端末の無線ゾーン間に於ける遷移の可能性を観測により求める第２の実施形態の手法は非常に有効である。

【００４７】前述の第１の実施形態では、無線端末２３２が将来どの方向に移動しても瞬断が生じないよう規定領域を設けるものであったが、これに対して、第２の実施形態では、無線端末２３２の移動可能な方向を過去のハンドオーバによる無線ゾーン間の遷移を観測して求め、無線端末の属する無線ゾーンとのその無線ゾーンが移動可能な方向にある無線ゾーンに対して、送信端末からの送信情報をマルチキャストする。これにより、瞬断を防止しつつマルチキャストする無線ゾーンの数を減らすことができるため、有線部分のみならず無線伝送路においても帯域を有効利用することができる。

【００４８】次に、無線端末２３２の移動可能な方向を求める手段を具体的に説明する。ここで、２７個の無線ゾーンを区別するためのＩＤ番号は図７に示した無線ゾーンに付された符号と同一とする。また、無線制御局２３３は、全ての無線ゾーンの位置関係を図５に示すテーブルとして記憶しているものとすると、各無線ゾーンから移動可能な隣接する無線ゾーンの数の最大値６であるから、無線ゾーン間の遷移は次式（１）の２７×６の行列G_{poss}で表すことができる。

【００４９】

【数１】

$$G_{poss}=\begin{bmatrix} g_{1,1} & g_{1,2} & g_{1,3} & \cdots & g_{1,6} \\ g_{2,1} & g_{2,2} & g_{2,3} & \cdots & g_{2,6} \\ g_{3,1} & g_{3,2} & \ddots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \ddots & g_{26,6} \\ g_{27,1} & g_{27,2} & \cdots & g_{27,5} & g_{27,6} \end{bmatrix} \quad \cdots (1)$$

【００５０】ここで、行列G_{poss}の各要素$g_{i,j}$の初期値を「０」とする。各行の番号ｉは無線ゾーンのＩＤ番号を表しているが、各行の要素は図５に示したテーブルの各行が示す無線ゾーンＩＤの要素に対応する。例えば、G_{poss}の一行目は、ＩＤ番号１の無線ゾーンから遷移可能な無線ゾーンを示しており、図５のテーブルに従って、$g_{1,1}$は、無線ゾーン１から無線ゾーン２への遷移、$g_{1,2}$は、無線ゾーン１から無線ゾーン７への遷

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移、$g_{1,3}$は、無線ゾーン１から無線ゾーン６への遷移を表している。無線ゾーン１から遷移可能な隣接する無線ゾーンは以上の３つだけであるから、$g_{1,4}$、$g_{1,5}$、$g_{1,6}$は意味を持たず、以下の説明から判るように、この場合は初期値が維持され「０」となる。

【００５１】行列G_{poss}は、無線ゾーン間で遷移が生じた時に、対応する無線ゾーン間の遷移を表す要素$g_{i,j}$を＊「１」に設定する。例えば、図７を例に考えると、同図の部屋には通路３０１があり、無線端末はこの通路でしか移動できないため、行列G_{poss}は次式（２）のようになる。

【００５２】

【数２】

$$G_{poss}=\begin{bmatrix}0&0&1&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\1&0&1&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\1&0&1&0&1&0\\0&0&1&0&0&1\\0&0&1&0&0&1\\0&0&1&0&0&1\\0&0&0&0&0&1\\0&1&0&1&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\1&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\end{bmatrix}\quad\cdots(2)$$

【００５３】このような処理により、実際に無線端末が移動しながら通信を行なう毎に無線ゾーン間の可能な遷移として獲得していく。これは、無線端末の移動可能な遷移を与えるため、部屋のレイアウトを反映したパターンになる。この獲得した式（２）に示したような無線ゾーン間の遷移情報を基に、遷移の可能性のある無線ゾーンに対してのみ送信端末からの情報をマルチキャストすることにより、有線網の帯域や無線チャネルを有効に利用することが可能となる。

【００５４】具体的には、前述の第１の実施形態の場合、無線ゾーン１４に存在する無線端末２３２に対し設定される規定領域は、無線ゾーン１４及びその回りの無線ゾーン８、９、１５、２０、１９、１３となるが、第２の実施形態の場合、式（２）のような遷移情報により、通路３０１の存在は把握できるため、規定領域は、無線ゾーン１４、１３、１５となる。従って、これらを比較すると、相手端末２３１からの送信情報をマルチキャストする無線ゾーンの数はより限定できることが容易にわかる。

【００５５】以上、説明したように、上記第２の実施形態によれば、無線端末２３２の移動に於ける無線ゾーン間の遷移履歴を記憶し、この記憶した遷移履歴情報から移動端末の移動可能な方向を求め、無線端末２３２が属する無線ゾーンの場所を基準とした規定領域を、この移動可能な方向に設けることにより、有線網の帯域や無線チャネルを有効に利用することが可能となる。

【００５６】（第３の実施形態）第３の実施形態では、無線端末の属する無線ゾーン間の遷移の頻度を観測してこの遷移する頻度の多い無線ゾーンに対して優先的に帯域を確保しマルチキャストすることを特徴とする。これにより、できるだけ有線網の帯域や無線チャネルを有効に利用しつつ瞬断の確率を下げることを目的としてい

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る。

【００５７】次に、無線端末２３２の属する無線ゾーンの遷移の頻度を観測して移動方向を予測する手段を図７を参照して具体的に説明する。ここで、第２の実施例と同様に、２７個の無線ゾーンを区別するためのＩＤ番号は図７に示した無線ゾーンの番号と同一とする。また、無線制御局２３３は、全ての無線ゾーンの位置関係を図＊

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＊５に示すテーブルとして記憶しているものとすると、各無線ゾーンから移動可能な隣接する無線ゾーンの数の最大値６であるから、無線ゾーン間の遷移の頻度は次式（３）の２７×６の行列Ｓで表すことができる。

【００５８】

【数３】

$$S=\begin{bmatrix} s_{1.1} & s_{1.2} & s_{1.3} & \cdots & s_{1.6} \\ s_{2.1} & s_{2.2} & s_{2.3} & \cdots & s_{2.6} \\ s_{3.1} & s_{3.2} & \ddots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \ddots & s_{26.6} \\ s_{27.1} & s_{27.2} & \cdots & s_{27.5} & s_{27.6} \end{bmatrix} \quad \cdots (3)$$

【００５９】ここで、行列Ｓの各要素$S_{i,i}$の初期値を「０」とする。各行の番号ｉは無線ゾーンのＩＤ番号を表しているが、各行の要素は図５に示したテーブルの各行が示す無線ゾーンＩＤの要素に対応する。例えば、行列Ｓの一行目は、ＩＤ番号「１」の無線ゾーンから遷移可能な無線ゾーンを示しており、図５のテーブルに従って、$S_{1,1}$は、無線ゾーン１から無線ゾーン２への遷移、$S_{1,2}$は、無線ゾーン１から無線ゾーン７への遷移、$S_{1,3}$は、無線ゾーン１から無線ゾーン６への遷移を表している。無線ゾーン１から遷移可能な隣接する無線ゾーンは以上の３つだけであるから、$S_{1,4}$、$S_{1,5}$、$S_{1,6}$は意味を持たず、以下の説明から判るように、この場合は初期値が維持され「０」となる。

【００６０】行列Ｓは、無線ゾーン間で遷移が生じた時に、対応する無線ゾーン間の遷移を表す要素$S_{i,i}$に「１」を加算する。この処理を繰り返すことによって、遷移の多いところほど、大きな値となる。例えば、図７を例に考えると、同図の部屋には通路３０１があり、無線端末はこの通路でしか移動できないため、行列Ｓは例えば次式（４）のようになる。

【００６１】

【数４】

$$S=\begin{bmatrix}
0&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&1&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
9&0&9&0&1&0\\
0&0&9&0&0&7\\
0&0&9&0&0&5\\
0&0&2&0&0&1\\
0&0&0&0&0&1\\
0&1&0&1&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
1&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0\\
0&0&0&0&0&0
\end{bmatrix}\quad\cdots(4)$$

【００６２】このような処理により、実際に無線端末が移動しながら通信を行なう毎に無線ゾーン間の遷移の頻度を獲得していく。この獲得した式（４）のような無線ゾーン間の遷移の頻度情報により、無線端末が移動する先の無線ゾーンを予測できる。すなわち、遷移の頻度の多い無線ゾーンに対しては無線端末が移動してくる確率が高いと考えられるため、優先的に帯域を確保し送信端末からの情報をマルチキャストすることにより、有線伝送路および無線伝送路の帯域を有効に利用することが可能となる。

【００６３】具体的には、無線ゾーン１４に存在する無線端末２３２に対し設定される規定領域は、第２の実施形態の場合、式（２）のような遷移情報により、通路３０１の存在は把握できるため、無線ゾーン１４、１３、１５となる。第３の実施形態の場合、式（４）のような遷移の頻度情報をもとに、行列Ｓの要素$s_{14,13}$の値が$s_{14,13}$の値より大きいこと、すなわち、無線ゾーン１４から無線ゾーン１５への遷移頻度の方が高いことが判断されると、規定領域は無線ゾーン１４、１５と設定される。言い換えれば、第２の実施形態の場合、無線ゾーン１４に存在する無線端末２３２の規定領域は、通路３０１に沿った無線ゾーン１４の前後の無線ゾーンとなる場合があるが、第３の実施形態によれば、さらにより移動遷移の可能性が高い無線ゾーン、例えば、無線ゾーン１４、１５に限定できることがわかる。

【００６４】以上説明したように、上記第３の実施形態によれば、無線端末２３２の移動に於ける無線ゾーン間の遷移の頻度を記憶し、この記憶した遷移履歴情報から移動端末の移動方向を予測し、無線端末２３２が属する無線ゾーンの場所を基準とした上記の規定領域を、その移動方向にある領域とすることにより、瞬断の確率を減らし、かつ、有線網の帯域や無線チャネルを有効に利用することが可能となる。

【００６５】さらに、第２の実施形態の移動方向の可能性の情報（式（２））を用いることにより、この予測の精度を上げ、規定領域の範囲を小さくすることができる。

（第４の実施形態）本発明の第４の実施形態では、無線端末の移動方向と移動速度を計測し、移動速度が大きいほど移動方向にある多くの無線ゾーンに対して送信端末からの送信情報をマルチキャストするものである。これにより、無線基地局までの有線部の帯域を早い時期に確保できるため、瞬断の確率を少なくすることが可能となる。

【００６６】これを実現するためには、式（３）の行列Ｓの各要素の無線ゾーン間の遷移時に対応する要素に

「１」が加算されて更新されるが、この更新タイミングを観測して遷移方向と遷移速度を同時に計測しておけばよい。この速度の大きさに応じてマルチキャストを行なう無線ゾーンを決定する。

【００６７】図８、図９を参照して具体的に説明する。なお、図８、図９は、図７同様、壁３００に囲まれた部屋にレイアウト変更で通路３０１が設定された部屋に、図２と同様に、無線ゾーン１～２７で無線伝送サービスを行なっている様子を示している。また、第２の実施形態で説明した無線端末の移動可能な方向、すなわち、通路３０１に沿った方向がすでに求められているとする。

【００６８】例えば、図８に示すように、無線ゾーン１３に無線端末２３２がいて、同図の矢印の方向に低速で移動している場合には無線ゾーン１３、１４（同図の太線の円）に送信端末２３１からの送信情報をマルチキャストする。これに対し、図９が示すように、無線ゾーン１３に無線端末２３２がおり、同図の矢印の方向にさらに高速で移動している場合には無線ゾーン１３、１４、１５（同図の太線の円）に送信端末２３１からの送信情報をマルチキャストする。

【００６９】具体的には、無線制御局２３３は、無線端末の移動速度に応じて規定領域の範囲を設定するため、例えば、無線制御局２３３は、全ての無線ゾーンの位置関係を図５に示すようなテーブルとして記憶している場合、これをダイナミックに参照して、無線端末２３２が無線ゾーン間を移動する際に、低速用の規定領域、高速用の規定領域の範囲を設定するようにしてもよい。すなわち、無線端末２３２が無線ゾーン１３に存在して、移動方向が図８の矢印で示す方向であることが検出された場合、移動速度が低速のときの規定領域の範囲は、無線ゾーン１３を基準として、あらかじめ検出された通路３０１に沿った無線端末２３２の移動方向にある最近傍の無線ゾーンのみでよいから、図５から直ちに無線ゾーン１４と設定することができる。一方、移動速度が高速のとき、規定領域の範囲は基準となる無線ゾーンの最近傍の無線ゾーンよりさらに広範囲に求める必要があるため、まず、図５のテーブルから無線基地局ＩＤ「１３」の最近傍無線基地局のうち、通路３０１に沿った無線端末２３２の移動方向にある無線ゾーンの最近傍無線基地局ＩＤ「１４」を得て、次に、図５のテーブルから無線基地局ＩＤ「１４」の最近傍無線基地局のうち、通路３０１に沿った無線端末２３２の移動方向にある無線ゾーンの無線基地局ＩＤ「１５」を獲得する。これにより、無線ゾーン１３に存在する無線端末２３２の移動速度が高速であるときの規定領域は、無線ゾーン１３、１４、１５となる。

【００７０】また、例えば、図５に示したような低速用の規定領域の範囲を示すテーブルと、それよりさらに広範囲に近傍無線基地局ＩＤを記憶した高速用の規定領域の範囲を示すテーブルをそれぞれ具備するようにしてもよい。

【００７１】さらに、例えば、第２の実施形態で説明した無線端末の移動可能な方向、すなわち、通路３０１に沿った方向が求められた時点で、前述しように、図５に示したテーブルをダイナミックに参照して、低速用と高速用の規定領域の範囲を獲得して、その結果を、移動速度が低速と高速のそれぞれの場合における規定領域の範囲をテーブルとして記憶するようにしてもよい。

【００７２】さて、図１０に示すように、矢印の方向に無線端末２３２が移動しており、無線端末２３２が属する無線ゾーン１３から無線ゾーン１４を経由して無線ゾーン１５に移動することが予想される状況を考える。無線端末２３２が無線ゾーン１３、１４を移動する間は、これらの無線ゾーンを担当する無線基地局２１３、２１４は交換機２５０に収容されているが、次の移動先である無線ゾーン１５の無線基地局２１５は異なる交換機２５１となる。この場合、交換機を切替える必要が生じ、その切替えに時間を要する。

【００７３】そこで、無線端末２３２の移動に伴い、無線制御局２３３で、無線端末２３２の移動方向と移動速度が検出されたとき、無線端末３２の移動方向にある無線ゾーンの無線基地局について、さらに、無線基地局とそれを収容する交換機の関係を表したテーブルを参照して、交換機の切り替えが予想される場合には、図１０に示すように、無線制御局２３３は、無線端末２３２が無線ゾーン１３にいる時点で早めに無線ゾーン１５を形成する無線基地局２１５を接続する交換機への有線網の帯域を確保する。これにより、瞬断の確率を低くすることができる。

【００７４】以上、説明したように、上記第４の実施形態によれば、無線端末の移動に於ける無線ゾーン間の遷移履歴の更新から移動端末の移動方向と移動速度を求め、無線端末２３２が属する無線ゾーンの場所を基準とした規定領域を、この無線端末の移動方向および移動速度に応じて変化させることにより、瞬断の確率を減らし、かつ、有線網の帯域や無線チャネルを有効に利用することが可能となる。この手段に、第２の実施形態の移動方向の可能性の情報（式（２））を用いることにより、規定領域の範囲ををさらに小さくすることができる。

【００７５】また、移動速度の大きい無線端末に対しては、この無線端末が属する無線ゾーンを基準として、より広い規定領域を設けてその規定領域の属する無線ゾーンに対して送信端末からの送信情報をマルチキャストすることでハンドオーバ時の瞬断の確率を減らすことができる。これは、移動速度の大きい無線端末ほど、単位時間当たりのハンドオーバの機会が多くなるため、無線端末の移動方向にある多くの無線ゾーンへ送信端末からの送信情報をマルチキャストすることが有効に機能するものである。

【００７６】さらに、現時点で無線端末を収容している無線基地局が接続されている交換機と、将来の移動先の無線ゾーンを収容する無線基地局が接続されている交換機が異なることが予測される場合には、送信端末の送信情報が後者の無線ゾーンを収容する無線基地局まで送信できるように後者の交換機の帯域を確保することにより、ハンドオーバ時の瞬断の確率を減らすことができる。

【００７７】（第５の実施形態）本発明の第５の実施形態では、無線端末２３２を使用するユーザがこれから使用する無線端末２３２を移動しながら使用するか、停止しながら使用するかを呼接続要求時に申告するものである。停止しての使用を申告した場合には、図１１が示すように無線端末２３２が属している無線ゾーン１４（同図の太線の円）に対してのみ、送信端末からの送信情報を伝送する。移動しながらの使用を申告した場合には、図１２が示すように、例えば移動可能性のある無線端末の属する無線ゾーン１４および（例えば、第２の実施形態で説明したように移動先となる可能性のある通路３０１に沿った）無線ゾーン１３、１５（同図の太線の円）に対して、送信端末からの送信情報を伝送する。また、移動することを申告する場合に、移動速度を申告して、速い移動速度を申告した場合には、第４の実施形態で説明したように、低い移動速度を申告した場合よりも、広い範囲にわたる無線ゾーンに対して送信端末からの送信情報をマルチキャストする。例えば、図１２は低速の場合を示しているとすると、速い移動速度を申告した場合には図１３のように、より多くの無線ゾーン（同図の太線の円）に対して上記のマルチキャストを実行する。

【００７８】無線端末２３２への着信シーケンスの場合を例にとり、具体的に説明すると、まず、待ち受けを行っている無線端末２３２は、無線基地局から送信される着信メッセージを受信し、着信を検出する。着信を検出した端末は、発信時と同様にして無線のリンクチャンネルを確立して、次に、レイヤ２を確立し、その後、レイヤ３の制御信号により、ネットワークとの間で、無線資源の管理、移動性、回線呼接続制御に関する申告、ネゴシエーションを行い、通信用のサービスチャンネルを確立する。ここで申告された情報、例えば、移動の有無、移動速度、通信要求品質等は、無線基地局およびそれを接続したネットワークを介して無線制御局２３３に渡される。無線制御局２３３では、受け取った申告情報と、具備されたテーブルを参照して規定領域を設定する。

【００７９】通常、無線端末２３２を高速で移動しながら用いる場合、音声を用いた情報のやりとりといった通信のように、それほど高い通信品質を要求するものではなが、一方、停止して、あるいは低速で移動しながら無線端末２３２を用いる場合、重要なデータを伝送している場合が多いと思われる。すなわち、高速で移動しながら無線端末を用いる場合、無線端末２３２を低速で移動しながら、あるいは、停止して用いる場合よりも、ネットワーク上の使用帯域は狭く、通信品質は低くあってもよい。

【００８０】そこで、無線制御局２３３では、上記申告情報を基に、移動速度の小さい無線端末に対して割り当てるネットワークの使用可能帯域を、移動速度の大きい無線端末に対して割り当てる使用可能帯域よりも広くするよう制御を行う。また、移動速度の小さい無線端末に対する通信品質を高くし、移動速度の大きい無線端末に対する通信品質を低くする制御を行なう。すなわち、図１において、無線制御局２３３は、ＡＴＭ交換機２３０に使用帯域、要求品質などの接続情報を含んだ信号をＡＴＭセルにて転送して、ＡＴＭ交換機２３０では、所定のコネクション受付制御を行う。

【００８１】これにより、移動しながら無線端末を使用するユーザと停止して無線端末を使用するユーザとの間で網資源利用の公平性を維持することが可能となる。また、移動速度の大きい無線端末に対しては通信品質を低くし、逆に移動速度の小さい無線端末に対しては通信品質を高くすることで、有線網の帯域の有効利用を図るとともに、高速に移動しながら無線端末を使用するユーザと低速または停止して無線端末を使用するユーザとの間で網資源利用の公平性を保持することが可能となる。

【００８２】以上説明したように、上記第１から第５の実施形態によれば、無線端末の移動にともなうハンドオーバ時の瞬断の可能性を極めて低く押さえ、しかも有線網の帯域や無線チャネルの利用効率の向上が図れる網制御装置を提供できる。

【００８３】すなわち、従来のセルラーシステムは、各無線ゾーンに於ける通信速度を高速化するためにミリ波などを利用するとその特質から無線ゾーンが狭くなる。無線ゾーンが狭くなることにより、無線端末の移動時に於けるハンドオーバが頻繁に生じるようになる。ハンドオーバ時には、無線基地局へ情報を伝送している有線系のコネクションを切替える必要があり、この切替えには時間を要するため、通信の瞬断が生じる。この瞬断は、通信品質を低下させるだけでなく、大量の情報を高速に伝送している場合には再送によって有線網に於ける伝送効率を低下させる。本発明により、この瞬断が生じる確率を大幅に減らすことが可能となる。また、移動する無線端末と停止して使用する無線端末に対する網資源の公平な割当を行なうことが可能となる。また、無線ゾーンが大きい場合にも本発明は有効に機能する。すなわち、無線ゾーン間の切替え境界に於ける複雑な形状に起因して、ハンドオーバが短時間の間に繰り返されるが、これにより瞬断を防止することが可能となる。なお、上記第１から第５の実施形態を適宜組み合わせて用いることも有効であることは言うまでもない。

【００８４】

【発明の効果】以上説明したように、本発明によれば、

無線端末の移動にともなうハンドオーバ時の瞬断の可能性を極めて低く押さえ、しかも有線網の帯域や無線チャネルの利用効率の向上が図れる網制御装置を提供できる。

【図面の簡単な説明】

【図１】本発明の第１の実施形態に係る通信システムの構成を概略的に示した図。

【図２】図１の無線基地局が形成するオフィス内の無線ゾーンの配置を示したもので、無線制御装置により設定される規定領域について説明するための図。

【図３】無線端末が無線ゾーン間を移動した際の図１の通信システムの動作を説明するための図。

【図４】図３の無線基地局が形成するオフィス内の無線ゾーンの配置を示したもので、無線制御装置により設定された規定領域について説明するための図。

【図５】無線制御局に具備される無線ゾーンの位置関係を記憶したテーブルの一具体例を示した図。

【図６】無線端末の無線ゾーン間の遷移を説明するための図。

【図７】本発明の第２の実施形態に係るオフィス内の無線ゾーンの配置と同オフィス内の通路を示したもので、無線端末の無線ゾーン間の遷移履歴をもとに、無線端末の移動可能な方向と移動すると推定される方向に設定される規定領域について説明するためのものである。

【図８】無線端末の移動速度が低速のときに設定される規定領域について説明するための図。

【図９】無線端末の移動速度が高速のときに設定される＊

＊規定領域について説明するための図。

【図１０】本発明の第４の実施形態に係る通信システムの構成を概略的に示した図で、無線端末の移動にともない交換機の切り替えが予想される場合の無線制御局の動作を説明するためのものである。

【図１１】無線端末を停止して使用する場合の規定領域について説明するための図。

【図１２】無線端末を移動しながら使用する場合の規定領域について説明するための図。

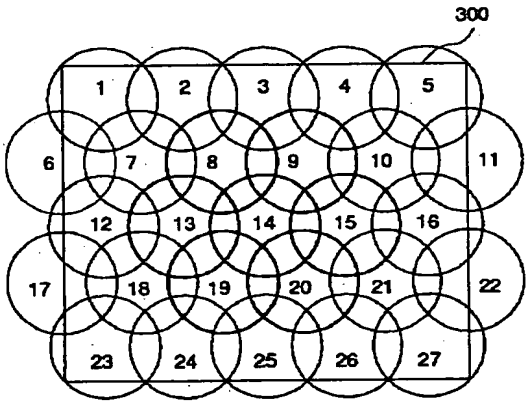
【図１３】無線端末を高速で移動しながら使用する場合の規定領域について説明するための図。

【図１４】従来の無線通信システムにおける無線制御局の動作を説明するための無線通信システムの構成を示した図。

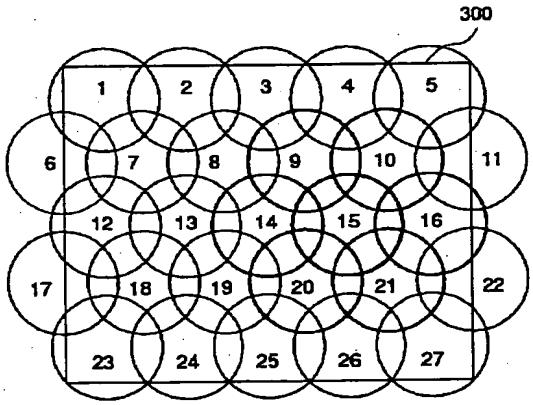
【符号の説明】

１～２７…無線ゾーン（無線基地局のカバーする無線ゾーン）、３１～３８…無線ゾーン（無線ゾーンの切替え境界線により分割された無線ゾーン）、１０１、１０２、１０３、１０４、１０５、１０６、１０７、２０８、２０９、２１０、２１３、２１４、２１５、２１６、２１９、２２０、２１２…無線基地局、１ａ～７ａ…無線ゾーン、１１０、１１１、２３０、２５０、２５１…交換機、１１２、２３１…送信端末（相手端末）、１１３、２３２…無線端末、３００…オフィスの壁、３０１…オフィス内の通路、１１４、２３３…無線制御局。

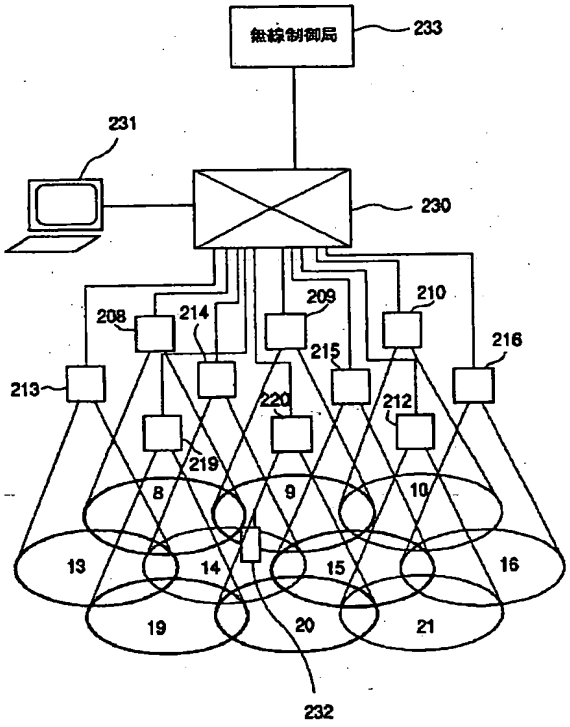
【図２】



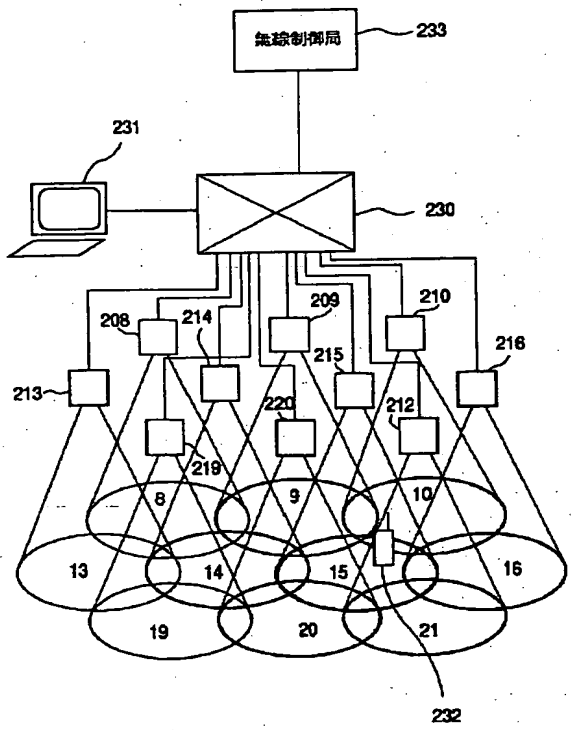
【図４】



【図１】



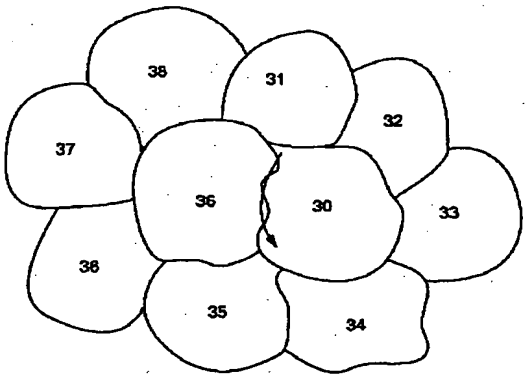
【図３】



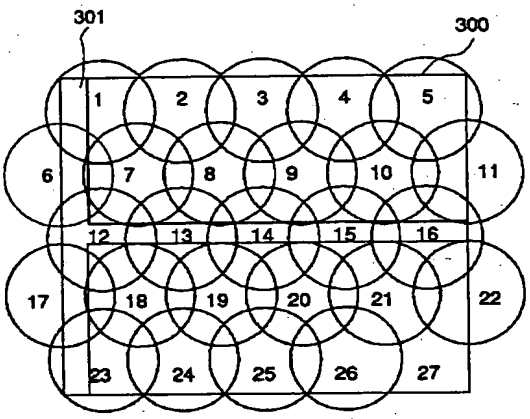
【図５】

無線基地局ID	近傍無線基地局ID					
1	2	7	6			
2	3	8	7	1		
3	4	9	8	2		
4	5	10	9	3		
6	1	7	12			
7	1	2	8	13	12	6
8	2	3	9	14	13	7
9	3	4	10	15	14	13
10	4	5	11	16	15	9
11	16	10	5			
12	6	7	13	18	17	
13	7	8	14	19	18	12
14	8	9	15	20	19	13
15	9	10	16	21	20	14
16	10	11	22	21	15	
17	12	18	23			
18	12	13	19	24	23	17
19	13	14	20	25	24	18
20	14	15	21	26	25	19
21	15	16	22	27	26	20
22	16	27	21			
23	17	18	24			
24	18	19	25	23		
25	19	20	26	24		
26	20	21	27	25		
27	21	22	26			

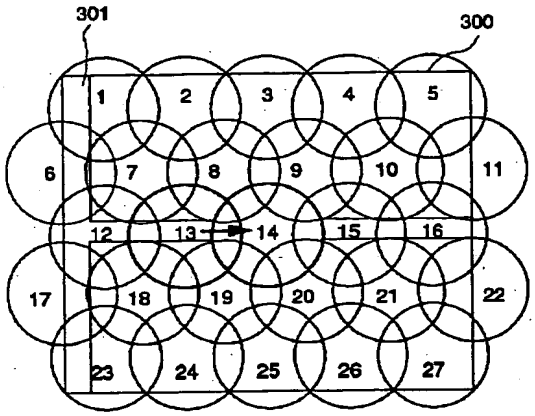
【図６】



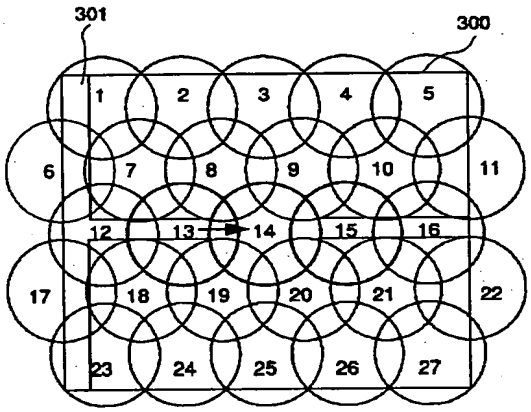
【図７】



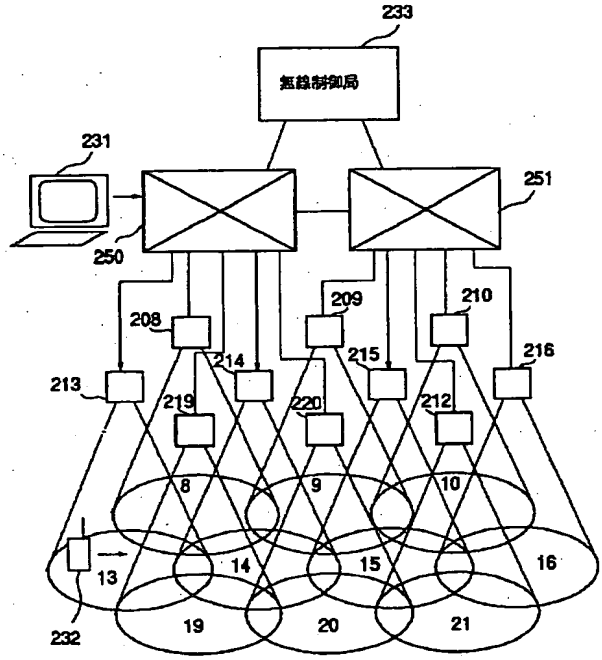
【図８】



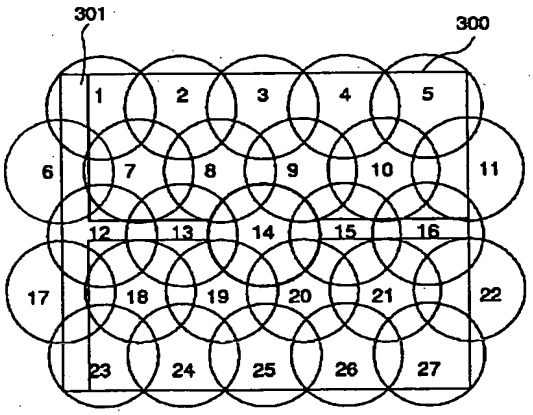
【図９】



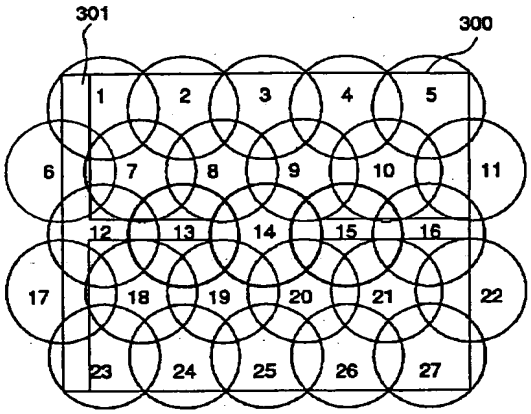
【図１０】



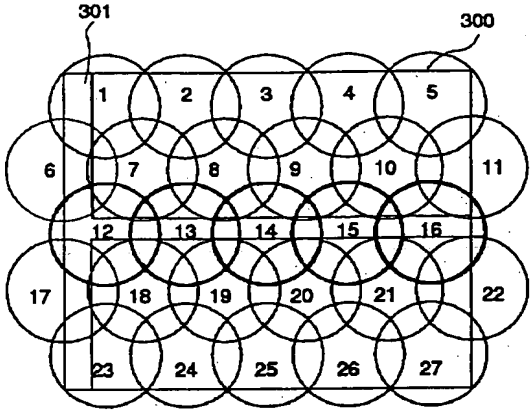
【図１１】



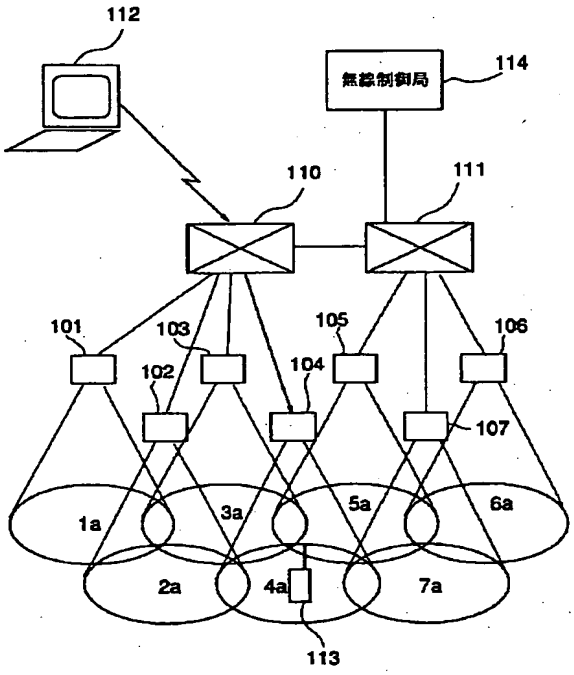
【図１２】



【図１３】



【図１４】



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